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Surgery, Gynecology and Obstetrics

WITH

International Abstract of Surgery

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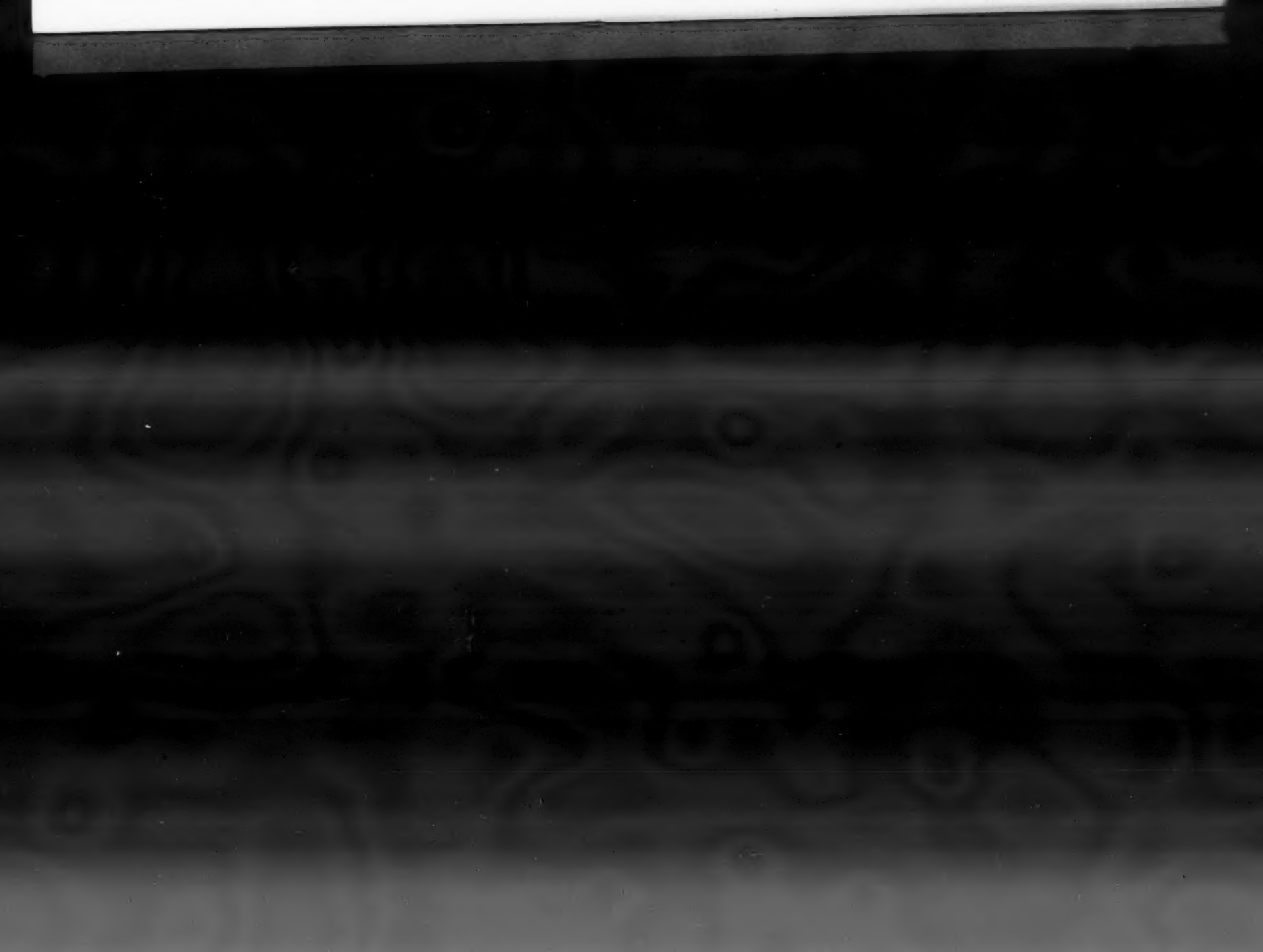

SURGERY, GYNECOLOGY AND OBSTETRICS

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GUNSHOT WOUNDS OF PERIPHERAL NERVES

BY BYRON STOOKEY, M.A., M.D., LOS ANGELES

Captain, Royal Army Medical Corps (Rel.); Temporary Assistant to Lieutenant-Colonel Robert Jones, Inspector of Military Orthopedic Surgery, British Army

THE very large number of peripheral nerve injuries in this war has been striking. Makins pointed out that injuries to peripheral nerves had undoubtedly increased in the Boer war due to the use of smaller bullets with high velocity. This was also the experience of Hashimoto and Tokuoka in the Russo-Japanese War. The latter also pointed out that with modern surgical methods fewer amputations are done, and in this way a greater number of gunshot injuries to peripheral nerves become apparent.

This paper is based on a study of seventy-five cases of nerve injuries. Table I shows the relative frequency of each lesion.

The number of nerve injuries in the upper extremity greatly exceeds those in the lower extremity; of those in the upper extremity the musculospiral was involved in 36 per cent, median in 17 per cent, and ulnar in 41 per cent. The frequency of musculospiral injury is probably due to its intimate relation to the humerus. Fracture, either complete or incomplete, of the humerus, occurred in 50 per cent of the musculospiral injuries.

In those of the lower extremity, the internal popliteal was not once injured, the external popliteal in four cases. The sciatic was completely involved, though never completely severed in any case, incompletely in eight cases, and the curious thing is that in each instance the portion forming the external popliteal was the part involved.

Since the work of Weir-Mitchell, Morehouse and Keen, in the special hospitals set aside at Philadelphia during the Civil War, very little new light has been thrown on the clinical manifestations of these lesions. The most admirable and thorough work of Head and his followers on peripheral nerves has done much to enlighten us as to the various forms of sensory loss and has served to give us a better understanding of the diagnosis and prognosis of these cases.

Our operative knowledge of nerve injuries is still in its infancy, not so far as the operative technique is concerned, but rather our operative judgment of these lesions: whether or not to excise that part of the nerve involved, or to perform neurolysis or partial resection; whether or not a given case is more suitable for nerve transference or nerve transplantation, etc., etc. These are problems of judgment which are now being decided and it seems imperative for those who are engaged in this work to record their results as early as possible, if only in a tentative manner, so that those cases to come may profit by our present experience.

The ideal operative procedure would be primary suture. This, however, is hardly ever possible in war surgery. This war has differed from all others because of the nature

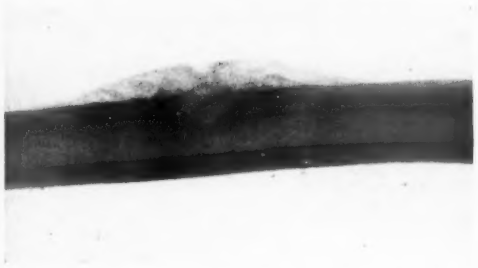


Fig. 1. X-Ray showing nicking of cortex with excessive callus formation, in which the musculospiral nerve became firmly embedded.

of the explosives used, and also due to the bacterial flora of a soil so richly manured. The bacteriology of wounds has been essentially that of fæces. Nearly all wounds are infected. This, of necessity, delays operative procedure and renders it more difficult because of the excessive scar formation. In operating on these wounds, two, three, or six months after injury, one is struck with the excessive amount of scar tissue present which, from the cutaneous wound, might have led one to believe the amount to be slight. Scar tissue widely infiltrates the deeper tissues, and, in many instances, becomes extremely dense. In those wounds in which there has been a fracture with infection — unfortunately this was a most frequent complication, more particularly in those cases coming from France and less so in the wounded from Gallipoli — scar tissue is enormous in amount, callus large, and the area of nerve involved extensive.

Nature of anatomical lesion. Peripheral nerves may be injured by direct violence of the bullet or shell, or indirectly by the velocity of the bullet and the transmission of its vibration, causing either concussion or contusion, usually both. This may cause a more or less transitory block to nerve conductivity. In some instances there appears to have been a hæmorrhage in the nerve-trunk. This may be absorbed and leave little after-impairment, or, on the other hand, may undergo organization with the foundation of dense scar in the nerve-trunk. I have seen such a case in which the nerve was injured apparently by concussion:

TABLE I.—RELATIVE FREQUENCY OF LESIONS

Nerve Lesion	Single	Combined	Total	With Fracture	Without Fracture	Total
UPPER EXTREMITY						
Musculospiral	20	4	24	12	12	24
Median	6	5	11	2	9	11
Ulnar	23	4	27	7	20	27
Musculocutaneous	..	1	1	1	..	1
Posterior Interosseus	1	..	1	1	..	1
External cutaneous	..	1	1	..	1	1
Radial	..	1	1	..	1	1
Total	50	16	66	23	43	66
LOWER EXTREMITY						
Sciatic	8	..	8	1	7	8
External popliteal	4	..	4	1	3	4
Total	12	..	12	2	10	12
MISCELLANEOUS						
Posterior thoracic	1	..	1	..	1	1
Brachial plexus	1	..	1	..	1	1
Sacral root	1	..	1	..	1	1
Pareses	2	..	2	1	1	2
Ischemic paralysis	1	..	1	1	..	1
Total	6	..	6	2	4	6

A63. Corporal N. Grenadier Guards. Ulnar nerve. Injury, September 27, 1915. Bullet wound at Hill 70. Range 10 yards.

Noticed two weeks after injury when splint was removed that sensation was "changed" in ulnar side of hand. This became more marked, and two months later the patient first noticed that he was unable to use the fourth and fifth fingers properly. The nerve was well away from the scar-tissue tract of the bullet. All the tissues about the nerve were normal, yet the nerve showed in a small portion of it, dense scar formation. The involved nerve was excised and the ends brought together.

In injury by direct violence the nerve may be completely or only partially severed. This seems to depend on the size of the nerve. I have never seen the sciatic nerve completely severed. In one instance it was notched by a bullet which had traversed both thighs, fracturing the femur in the opposite limb. In this case two-thirds of the nerve was cut away, as if it had been excised with a knife.

The nerve may be injured by indirect violence due to explosive effect of bullet and the velocity imparted to bits of bone, or even the parts of the accoutrement of a soldier. I have removed a tooth from the axilla lying against the posterior cord, the bullet having traversed the mandibula, comminuting it, and then having passed through the axilla. In another instance an entire English bullet, unexploded, was removed from the thigh.

Fig. 2. A47. Complete musculospiral paralysis showing recovery five and one-half months after operation.

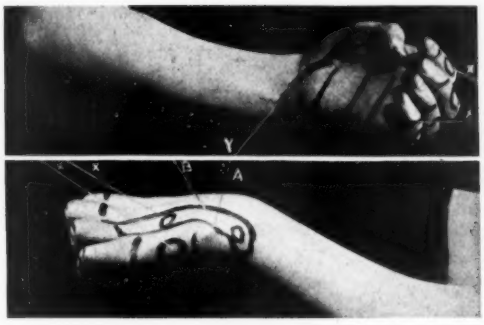


Fig. 3. A57. Contractures in case of involvement of the median and ulnar nerves. *A*, boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, extreme degrees lost in both cotton-wool and pin-prick areas; *Y*, boundaries of cotton-wool and pin-prick area coterminus.

The use of high explosives has made the wounds in many cases more frightful than in previous wars.

Nerve lesions, when seen later, usually show the nerve involved in a mass of scar tissue, in many instances extremely dense. When the nerve is completely severed, the proximal end is usually bulbous, hard, and slightly irregular; the distal end small, frayed, lost, and diffused in surrounding scar.

Secondary implication of the nerves arises in wounds to soft parts, or to those involving the bony structure, either by an overgrowth of scar tissue, or callus, or both. Involvement of the musculospiral nerve in callus was more frequent than of any other nerve, due probably to its intimate relation to the humerus, the frequency with which injuries to the upper extremity occurred, and to the frequent extreme degree of comminution. In twenty-four cases of musculospiral injury 50 per cent were complicated by fracture. I have seen the nerve involved in callus in two cases in which there was not a complete fracture but in which only a nicking of cortex had occurred, yet the nerve was completely embedded in callus which appeared to be excessive (see Fig. 1). It is possible that the pressure of the nerve against the torn and frayed cortex and periosteum acted as a foreign body and additional stimulus to excessive bone formation.

Considering, then, the nature of these nerve injuries we may have either complete anatomical or physiological, or incomplete anatomical or physiological division. Unfortunately, we are not able to distinguish before operation between a complete anatomical or physiological lesion. Both destroy conductivity of the nerve. Hence both manifest themselves functionally in the same manner. However, we are able to distinguish in most instances between complete or incomplete lesions. The latter, so aptly described by Keen, usually complain of neuralgic pains. The extremities show a glossy, shiny, mottled, red skin, tender in parts to nearly all stimuli. The skin is usually drawn tight over the fingers, and the subcutaneous tissue appears to be small in amount. There is usually sweating which, as others have pointed out, is markedly acid and of strong odor. Sweating does not usually occur in excess unless there is an irritative incomplete lesion.

As we have said, the ideal treatment is primary suture, which, unfortunately, is impracticable in war surgery. In cases of complete division, either anatomical or physiological, operations should be performed as soon as the primary wounds have completely healed. One should bear in mind, however, the possibility of recrudescence of infection in cases in which there are no obvious signs, particularly in those wounds complicated by fracture. In these it is occasionally found at operation that a small bit of bone lies loose in scar tissue and is surrounded by a drop of mucopurulent fluid. Such a complication, unfortunately, cannot be fore-

Fig. 4. A41. Splint to prevent wrist-drop.

seen, even though apparently an adequate time has been waited. It is better to delay longer in those cases in which there has been a fracture, particularly if there has been much comminution and small bits of metal remaining. In view of the pathological findings in the majority of cases, it does not seem justifiable to delay operation three, six, or eight months to see if the nerve will not unite unassisted. Exploratory operations seem to me to be justifiable in all cases in which there is no contra-indication to operation. Usually exploration of the nerve is extremely simple, and even if one decides to do nothing, no special harm has been done, and the patient has had the advantage of the possibility of lessening his convalescence by six to eight months. Delay in operating in most instances means delay in recovery.

In cases of incomplete division, delay seems more justifiable than in complete division. But even in these, expectant treatment in the end may be disappointing and operative interference becomes then imperative.

At operation in these nerve injuries decision as to what to do in the simple case is easy. Unfortunately, the simple case is rare. When the nerve is freed and the scar tissue removed, there may remain a gap of several centimeters or more. Several expedients are open: First, tubulization, using hardened arteries or Cargile membrane and threading the nerve-ends together. In no such case have I seen any improvement at all, in fact, the whole condition has become worse. The other alternatives are to do transplantation using the radial nerve or saphenous nerve. The object in transplanting another nerve is to avail ourselves of whatever power of regeneration the neurilemma of the transplanted nerve may possess. Should this not

Fig. 5. Fixed outside iron to prevent foot-drop.

be possible, one may do nerve transference which, in suitable cases and positions in relation to adjacent nerves seems to me the operation of choice.

In certain cases, if at the point selected in the nerve to be used, the fibers are mainly sensory, double transference should be done; that is, the proximal as well as the distal ends of the severed nerve should be joined to the nerve-trunk to which transference is to be done. The nerve-trunk thus acts as a scaffolding along which new motor fibers may grow to join the distal end of the severed nerve without re-education of other and new nerve-centers.

Two methods should be condemned; namely, nerve-stretching and suturing with the limb markedly flexed, which in reality becomes suturing under tension. Warrington has shown that nerve-stretching causes karyolysis of the nerve-cell in the anterior horn and subsequent degeneration of the cell axon; thus one establishes degeneration in the proximal portion of the nerve, which is surely most undesirable. When the nerve is sutured with the limb flexed there is usually some tension. Later, when the limb is slowly straightened the scar of union of the

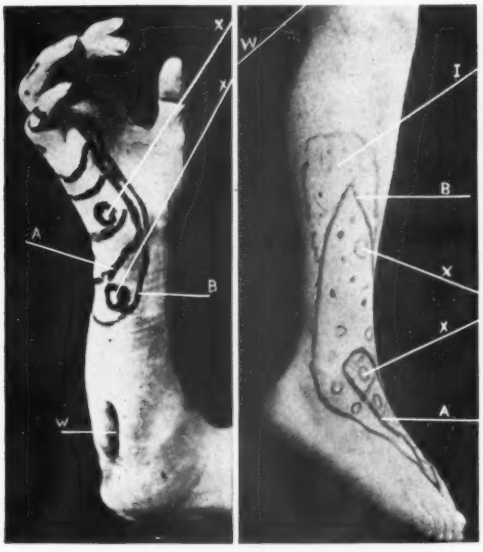


Fig. 6 (at left). A33. Ulnar nerve involvement. *A*, Boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, extreme degrees lost in both cotton-wool and pin-prick area; *W*, wound of entrance.

Fig. 8. A10 External popliteal nerve involvement. *A*, Boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, extreme degrees lost in both cotton-wool and pin-prick areas; *W*, operative wound and wound of entrance; *I*, indefinite area, cotton-wool felt, intermediate degrees lost.

two ends becomes slowly and gradually stretched, so that in place of a linear scar a fusiform, elongated scar occurs, which, again in turn, becomes hardened with an increase of scar tissue and the aim of the operation annulled.

The temptation to excise all hardened tissues about the nerve may lead one into greater difficulties and prolong convalescence. We know that nerve-fibers will grow through considerable tissue resistance. If then, at operation, this be borne in mind and in place of free excision, in suitable cases the nerve be freed and wrapped with a flap of fat or other suitable tissue, recovery is more rapid and more complete. In the two following cases the nerve was found embedded in scar tissue and was somewhat hardened and slightly bulbous. The nerve was freed and wrapped with protective tissue. Both have shown the most rapid recovery — the motor power has returned in less than six months in both instances.

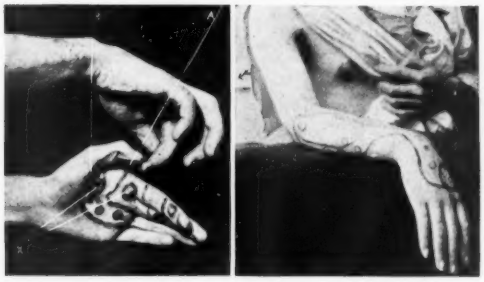


Fig. 7 (at left). A8. Median nerve involvement. Tendon of thumb involved in scar. *A*, Boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, extreme degrees lost in both cotton-wool and pin-prick areas.

Fig. 9. A39. Musculospiral nerve involvement with cotton-wool lost only in area over bases of second and third fingers. In all the remaining area outlined cotton-wool felt, yet moderate and extreme degrees lost.

A47. Private J. Fourth Welsh Regiment. Musculospiral nerve. Bullet wound at Dardanelles, August 10, 1915. Entrance: posteriorly, at level of deltoid eminence. Exit: anteriorly, lateral border of biceps three inches above external condyle. No fracture.

Muscular examination showed complete paralysis of the supinator longus, extensors of wrist, thumb, and fingers. Sensation showed loss to cotton-wool over dorsum of thumb and first interspace, extending on to second finger and on to a small portion of the metacarpal phalangeal joint of this finger. Extreme cold, 10°, invariably called warm, elsewhere the same test-tube appreciated as such. Heat, 65°, appreciated as warm, not hot; 20° called warm. Pin-prick everywhere appreciated. The patient was operated upon September 4, 1915, and the nerve found embedded in scar tissue. There was no bulbous enlargement on the nerve, but the nerve was thickened and hardened in one spot. It was considered better not to resect. Subcutaneous fat from the thigh was wrapped around the nerve and fixed with catgut. Three and a half months after operation there was slight voluntary power over the wrist and fingers. On April 27, 1916, five and a half months after operation, the patient was able to raise the wrist and fingers voluntarily, and supination was readily done against resistance (Fig. 2).

A49. Private C. Sixth Leinsters. Sciatic nerve. Wounded at Chocolate Hill, Gallipoli, August 10, 1915. Bullet wound. Entrance: just behind hamstrings mesially. Exit: just above tendon of biceps. Scar of wound freely movable, and there is no painful area about scar. No bony injury.

Immediately after injury the patient noticed that the leg was numb and he had to be assisted down to the dressing-station on the beach. One month later the patient noticed extreme pain over the dorsal and lateral surfaces of the foot, described as like

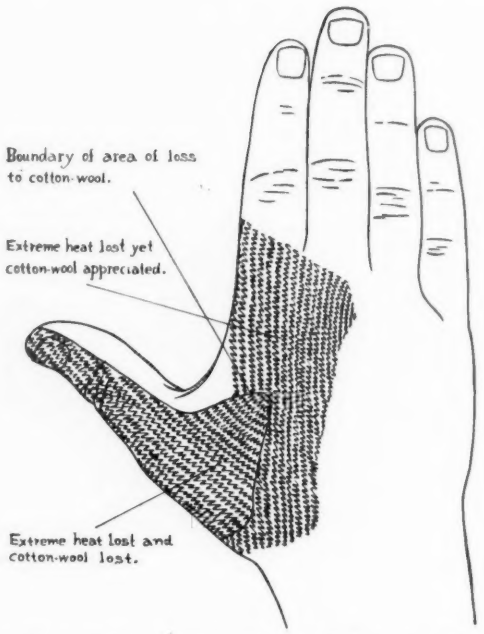

Boundary of area of loss to cotton-wool.
Extreme heat lost yet cotton-wool appreciated.
Extreme heat lost and cotton-wool lost.

Fig. 10. Chart 1, A78. Musculospiral nerve. Black line indicates boundary of area of loss to cotton-wool. Pin-prick everywhere felt. Extreme heat lost in area indicated by wavy line, even where cotton-wool is felt.

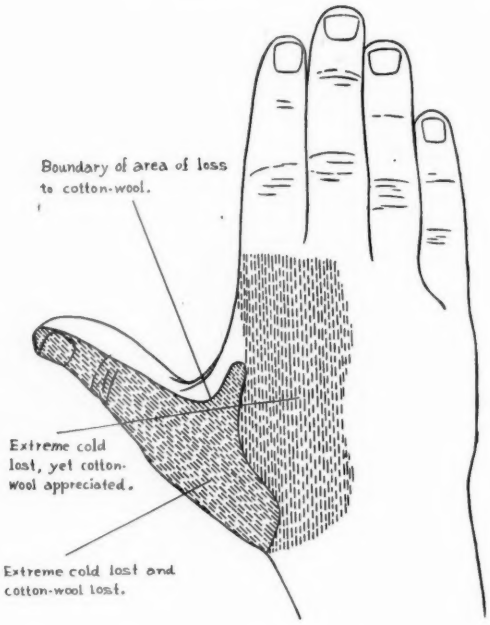

Boundary of area of loss to cotton-wool.
Extreme cold lost, yet cotton-wool appreciated.
Extreme cold lost and cotton-wool lost.

Fig. 11a. Chart 2a, A7. Musculospiral nerve. Area shaded by dash line indicates loss to extreme cold. Dark line along border of thumb across the interspace is the boundary of loss to cotton-wool. Pin-prick everywhere appreciated yet extreme cold lost, not only in cotton-wool area, but also over dorsum of hand where both cotton-wool and pin-prick are appreciated.

a big, hot iron "seared off foot." This pain lasted until operation. The patient had foot-drop. Operation October 6, 1915, The external popliteal portion of the sciatic nerve was partially severed and adherent in scar tissue. The cut edges were sutured and the nerve freed from scar tissue. There was no tissue wrapped about it. On March 1, 1916, six months later, the patient noticed that he was able to dorsiflex the foot slightly. On April 3, 1916, seven months after operation, he was able to dorsiflex the foot voluntarily against resistance. In this case sensory loss is still present, whereas there is return of motor function.

Both before and after operative interference, the greatest emphasis must be laid on efficient and adequate treatment to prevent contractures and overstretching of the muscle groups whose nerve supply has been cut off (see Fig. 3).

This picture shows a case of median and ulnar nerve lesion in the middle third of the forearm in which, due to inadequate splinting, contractures set in. This case came to us after the contracture was well developed. All efforts at reduction, even under ether, were in vain. Due to the loss of sensation and the vulnerability of such skin, deprived of its greatest protection, i.e., pain sense, pressure sores readily develop and rapidly enlarge.

The principle of splinting in nerve cases is to prevent contractures and overstretching of the muscles, for we know that such muscles when overstretched undergo more rapid degeneration.

Figure 4, A41, shows method of splinting in cases of wrist-drop. The splint is a simple metal sheet which can be readily made into any angle.

Figure 5, A49, shows method of preventing foot-drop by using fixed outside iron. With this simple device the patient is able to be about freely with hardly any noticeable limp. It is amazing the slight inconvenience produced by extensive nerve lesions, such as the sciatic.

Most valuable adjutants to proper splinting are constant and regular massage, hot and cold contrast baths, and the galvanic current. These must be systematically done,

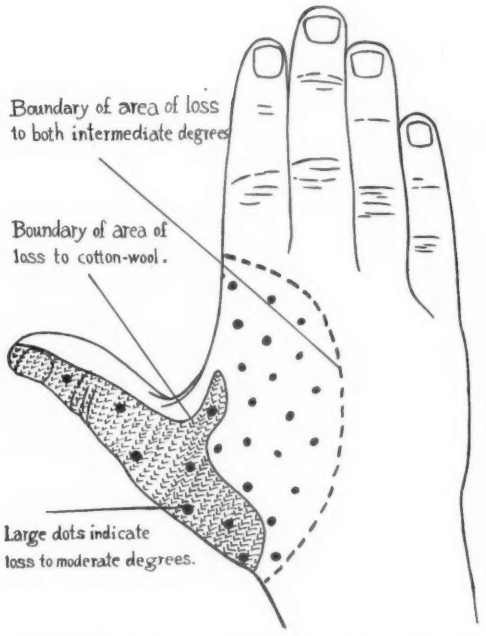

Boundary of area of loss to both intermediate degrees
Boundary of area of loss to cotton-wool.
Large dots indicate loss to moderate degrees.

Fig. 11b. Chart 2b, A7. Same case as in previous chart. Area shaded with ticks indicates loss to cotton-wool. Interrupted line is boundary of loss to both intermediate degrees. These it will be seen, are lost not only in cotton-wool area, but also where cotton-wool is appreciated. Pin-prick is everywhere felt.

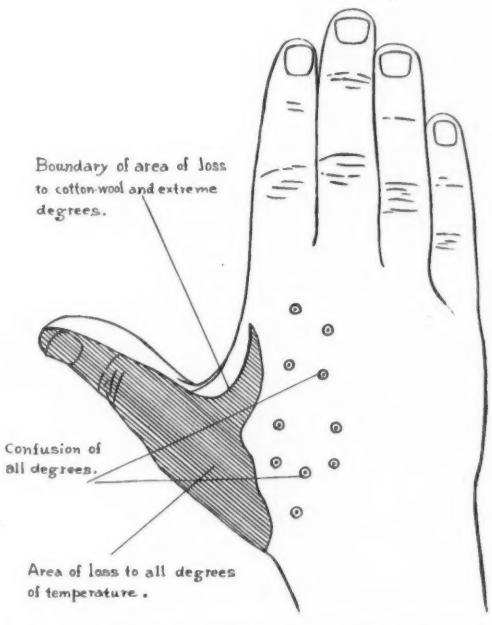

Boundary of area of loss to cotton-wool and extreme degrees.
Confusion of all degrees.
Area of loss to all degrees of temperature.

Fig. 12. Chart 3, A41. Musculospiral nerve, lower third. Same case whose X-ray is shown in Fig. 1. Extreme degrees and cotton-wool lost in area shaded with straight line. Pin-prick here and over rest of hand readily appreciated. Outside shaded area there is an indefinite area where extreme degrees are confused, indicated by circles with dots.

and modified according to the stage of improvement. This is best watched by the careful charting of the sensory findings, more especially the loss to pin-prick which is of greater value than electrical tests of muscular reactions.

Accurate determination of sensory changes and the careful subsequent re-examination of the sensory findings give more valuable information both as to the extent of the injury and the rate of recovery than the muscular reactions. Careful charts should be kept and due attention paid to the contraction of the borders of sensory loss. Shrinkage of these, more especially of the border of loss to the sense of pin-prick, is of the greatest value and interest.

The division of sensation into epicritic, protopathic, and deep has been useful and productive of great advances in the study of nerve lesions. I will not discuss at this time whether these terms represent a series of nerve systems within the nerve-trunk, or rather different degrees of conductivity. From a clinical standpoint, however, to continue in the use of these terms, epicritic and protopathic, appears to me to be misleading.

They are supposed to be comprehensive and to represent certain forms of sensory loss. In the so-called epicritic area we infer that there is loss to cotton-wool, to moderate degrees, and that the two points of the compass are not discriminated. Hence, were we to call a given area epicritic we at once picture the loss to all of the above. Such is not the case in many instances. In fact, I have frequently found the so-called epicritic area in which cotton-wool was lost and yet the pin-prick felt, in which, however, extreme degrees of heat were also lost. (See Figs. 6, 7, and 8.) If this is the epicritic area *extreme degrees* should be felt as such.

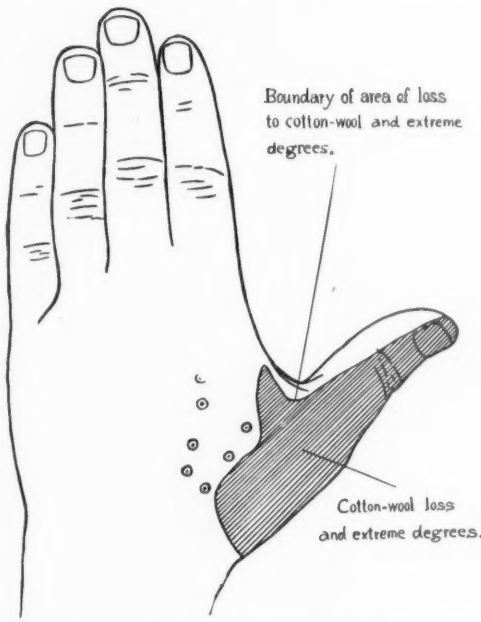


Fig. 13. Chart 4, A48. Musculospiral nerve, wound high in axilla. Extreme degrees and cotton-wool lost in area shaded with straight line. Pin-prick here and over rest of hand readily appreciated. Outside shaded area there is an indefinite area where extreme degrees are confused, indicated by circles with dots.

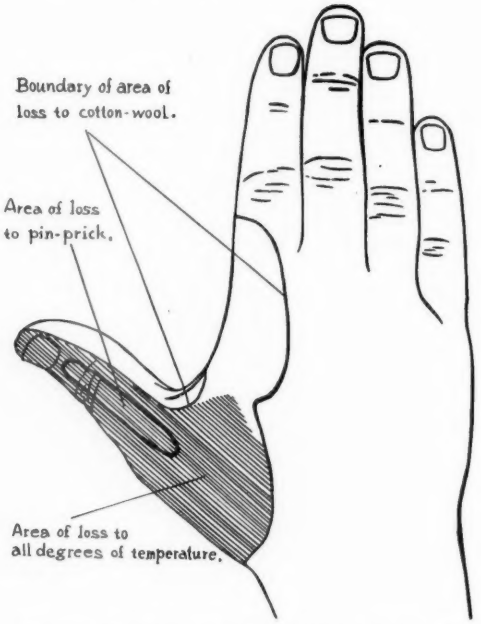


Fig. 14. Chart 5, A76. Musculospiral nerve, lower third. Outer line indicates boundary of area of loss to cotton-wool. Within the heavily shaded line on the dorsum of the thumb there is loss to pin-prick the area which is covered by straight lines indicates loss to extreme degrees.

Indeed, in certain cases I found areas where cotton-wool *was appreciated* as such and yet extreme degrees *were lost* (Fig. 9).

From the term protopathic we imply loss to cotton-wool, pin-prick, and extreme degrees as well, yet here is a case, see Fig. 10, Chart 1, in which pin-prick is appreciated and yet in this area extreme degrees are lost.

If we adhere to these terms epicritic and protopathic, how then are we to designate with accuracy such areas? These are not isolated examples, but, in fact, are rather more representative. I have therefore abandoned the use of the terms epicritic and protopathic and use in their stead the specific terms, cotton-wool area, pin-prick area, areas of loss to moderate and extreme degrees, etc. This seems to me to be less confusing and more accurate.

The object of the terms epicritic and protopathic, etc., was to serve to indicate that there exists various forms of sensory loss. This end may be better attained by giving to each quality of sensation its own particular name; i.e., cotton-wool area, pin-prick area, areas of moderate and extreme degrees.

In order to make certain that temperature sense was accurately tested, controls were invariably used at the same time by touching with the same test-tube a normal part of the skin, preferably a corresponding area on the sound side. Large test-tubes were used, and temperatures maintained at 60° to 65° for extreme heat, and 10° to 14° for extreme cold; 20° to 40° respectively for moderate cold and heat.

The tube is rolled gently over the involved area, care being taken to change the tubes frequently to allow for loss of heat. If the patient "says" hot and resents touch of the tube in the normal area yet over the area of

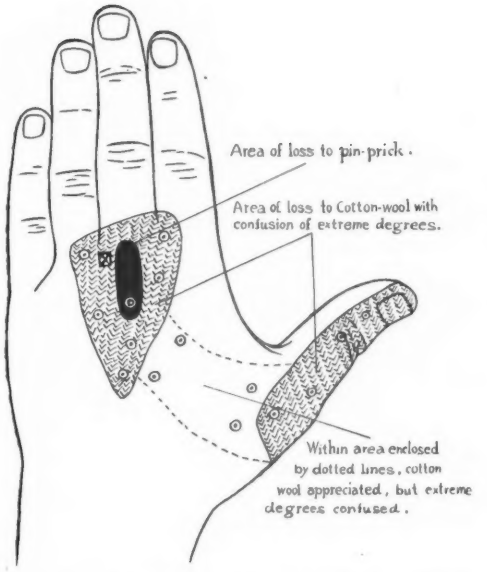

Area of loss to pin-prick.
Area of loss to Cotton-wool with confusion of extreme degrees.
Within area enclosed by dotted lines, cotton wool appreciated, but extreme degrees confused.

Fig. 15. Chart 6, A46. Musculospiral nerve, middle third. Shaded areas over thumb and dorsum of hand indicate loss to cotton-wool. The heavily shaded area in the latter portion indicates area of loss to pin-prick; everywhere else appreciated. Just outside this area of loss to prin-prick there is a slight burn done by a cigarette, indicated on the chart by a small square area. Running across first interspace there is an indefinite area where cotton-wool is appreciated, but there is confusion of extreme degrees.

loss of sensation fails to appreciate it as such, it can hardly be said that the surface heat of the tube is lost, and the temperature with which the patient comes in contact is in reality only moderate heat, if even that. In all cases such controls were invariably made with each set of temperatures.

A study of areas of temperature loss in these injuries has been most interesting. Frequently the area of loss to extreme heat exceeds that to extreme cold, and vice versa (Fig. 11 a and b, Charts 2 a and b).

The loss to extreme degrees, as we have said, is not confined to the pin-prick area alone as we might have been led to suppose by the use of the term protopathic. In these cases, Fig. 12, Chart 3, Sergt. L. and Fig. 13, Chart 4, Lanc. Corporal R., both extreme degrees were lost, yet no loss to pin-prick. Extreme degrees were lost over dorsum of

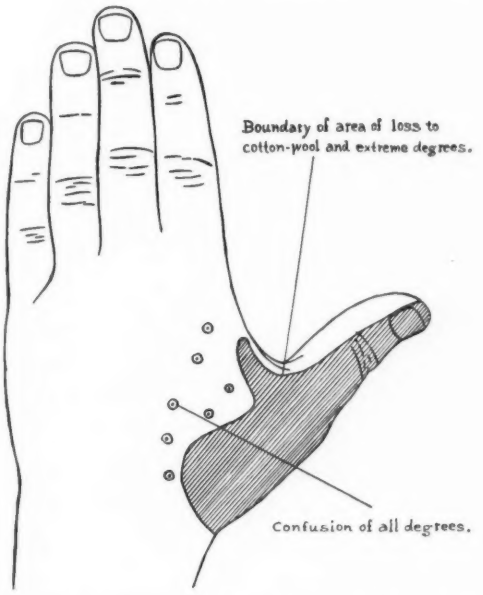


Fig. 16a. Chart 7a, A48. Posterior cord, just above clavicle. Area on thumb shaded, no loss to pin-prick; cotton-wool and extreme degrees are also lost.

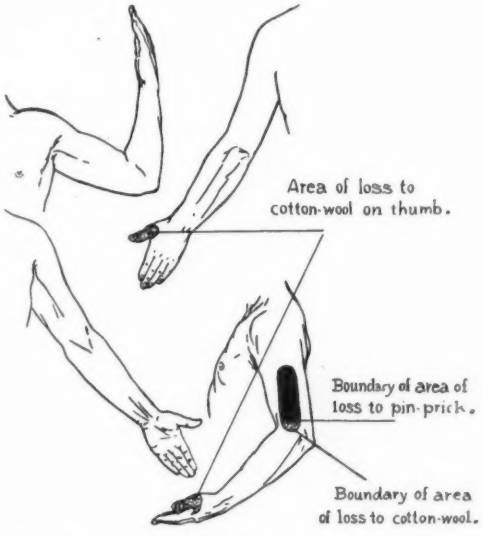


Fig. 16b. Chart 7b, A48. Same case as in Fig. 16a. Shows additional loss to cotton-wool and pin-prick on lateral surface of arm. In this entire area extreme degrees are also lost.

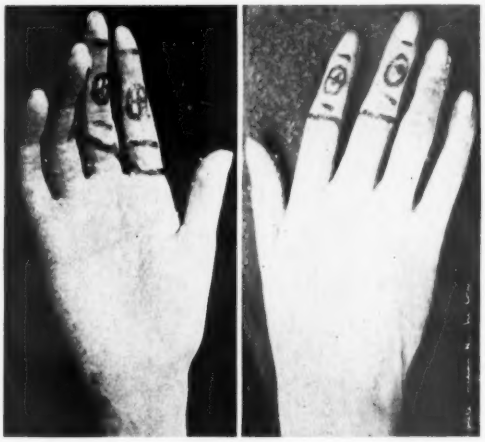


Fig. 17. A37. Incomplete median nerve. No loss to cotton-wool. Areas outlined show loss to pin-prick and extreme heat. Extreme cold appreciated.

thumb, yet pin-prick was readily appreciated everywhere.

It has been a truism that certain nerves may be severed in certain portions of their course without any demonstrable loss of sensation. Perhaps the most striking example of this is the musculospiral in its lower third below the origin of its lateral cutaneous branches. Injury here, it is said, gives rise to no loss of sensation. In several cases in which the lateral cutaneous branches have not been involved I have been able to outline an area on the dorsum of the thumb in which there was loss to cotton-wool and to both moderate and extreme degrees (Fig. 14, Chart 5).

In other cases I have been able to outline as well an area over the dorsum of the hand, principally in the axis of the third finger in which cotton-wool and extreme degrees were

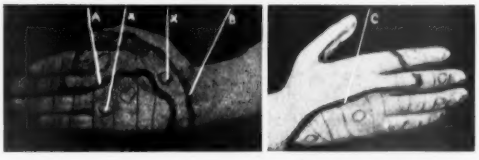


Fig. 18. A13. Combined lesion of median and ulnar nerve. *A*, Boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, extreme degrees lost in both cotton-wool and pin-prick areas. In the posterior view of same case, *C*, cotton-wool and pin-prick co-terminus.

Fig. 19. A4. Ulnar nerve involvement showing typical loss of sensation. *A*, Pin-prick area, with loss of extreme degrees; *B* cotton-wool area.

confused, and in only a small portion, loss to pin-prick (Fig. 15, Chart, 6).

There can be no doubt as to the loss of sensation in this case, for he burnt himself over the third metacarpal phalangeal joint without recognizing that he had done so until he saw the burn.

In certain other cases of injury to the musculospiral no loss to cotton-wool or pin-prick could be made out, yet over the dorsum of the hand and on to the dorsum of the thumb there was confusion of degrees, 20° to 40°, both called warm, yet the same tubes at the same time on corresponding areas of the other hands were at once differentiated. Extreme degrees, 9° to 65°, were described as "just warm" and "just cold." The same tubes on other hand were at once described as "hot" and "icy cold."

In one case of injury to the posterior cord just above the clavicle and just above the origin of the subscapular nerves, the only loss of sensation which we could make out was a small area over the dorsum of the arm below and at the level of the insertion of the deltoid, and on the dorsum of the thumb and slightly in the first interspace. In the area on the arm the loss to cotton-wool and pin-prick was nearly co-terminus. In the area on the thumb no loss to pin-prick could be made out, yet extreme degrees were lost. (Fig. 16a, Chart 7a, A48. Lance. Corporal R.—Bayonet wound.)

In still another case in which the musculospiral was wounded high up in the axilla with subsequent paralysis of triceps, supinators, and all extensors of the thumb and wrist, there was no loss of any form of sensation to be made out. This is the only case in which we have found no loss of sensation.

Care must be taken in examining the dor-

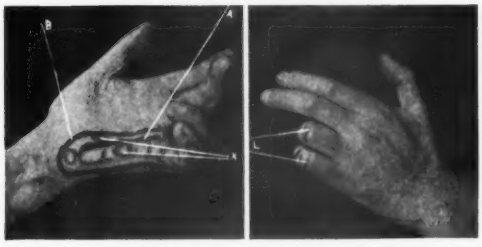


Fig. 20. A45. Ulnar nerve involvement. Anterior view: Posterior cutaneous division not involved, shows typical ulnar loss. *A*, Boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, extreme degrees lost in both cotton-wool and pin-prick areas. Posterior view: Ulnar nerve posterior division not involved. No loss of sensation on dorsum of hand or proximal phalanges. Loss of sensation on distal two phalanges of the fourth and fifth fingers. *L*, Boundary of loss on posterior surface of fingers.

sum of the thumb for loss to cotton-wool that the test is made *longitudinally* in the axis of thumb. If the patient is tested by stroking transversally one is apt to impinge on the lateral borders of the thumb which are supplied by the median nerve, and thus the patient exclaims that he is able to feel cotton-wool, whereas in reality he does not except in the area of the median supply.

From the musculospiral injuries we have had, it would seem fair to conclude:

Injury of the nerve in its lower third without injury to the external cutaneous branches or to the radial may give rise to loss of sensation over the dorsum of the hand, more especially over the dorsum of the thumb and first interspace.

Injury to the nerve high in its course may give rise to no loss of sensation either over the area of distribution of the radial nerve or the external cutaneous branches.

Injury to the musculospiral nerve may give rise to loss of sensation to both moderate and

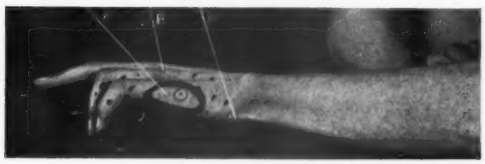


Fig. 22. A20. Ulnar nerve above elbow. No loss of sensation to cotton-wool except within the heavy oval. *B*, Cotton-wool here felt, intermediate degrees lost; *X*, cotton-wool and extreme degrees lost in this area.

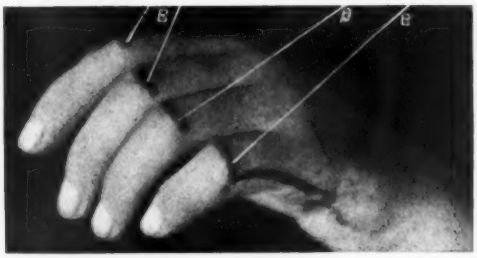


Fig. 21. A65. Median and ulnar nerve involvement. Posterior division of ulnar not involved. Shows no loss of sensation over proximal phalanges, usually supplied by the ulnar. *B*, boundary of loss to cotton-wool.

extreme degrees, without loss of sensation to cotton-wool or pin-prick.

Some observers have cited as typical of median distribution sensation on the dorsum of the thumb. This I have never found in any case, though I have paid special attention to this point. The supply of the median extends laterally up to a line drawn as a continuation of the lateral borders of the nail. In all cases either before or after operation in whom the exact nature and site of the median nerve lesion was known, I have never found a loss of sensation extending beyond this line.

In one case of incomplete median nerve injury, there was no loss to cotton-wool except over the distal two phalanges of the second and third fingers on both surfaces extending on the flexor surface, over the proximal phalanx of the second finger (see Fig. 17, a37, Lance Corporal M.). Over this area

Fig. 23 (at left). A12. Ulnar paralysis. Note separation of fingers possible, due to extensors and marked wasting of interosseous spaces.

Fig. 24. Same case as in Fig. 23. With the fingers bent at right angles at the metacarpal phalangeal joints, separation is impossible.

Fig. 25. A46. Musculospiral nerve with paralysis of all extensors. Note separation possible with fingers bent at right angles.

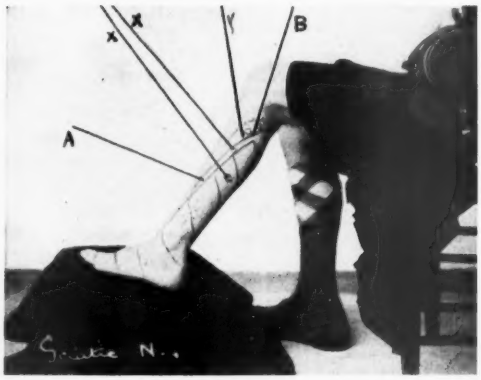


Fig. 26. Sciatic nerve involvement. *A*, Boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, extreme degrees lost in both cotton-wool and pin-prick areas; *Y*, indefinite area where cotton-wool is felt, extreme degrees lost.

pin-prick was lost and also extreme heat, yet extreme cold was appreciated.

The remainder of our series of median nerve injuries were extremely typical, with loss of sensation in palm and to half of fourth finger, and the dorsal surface of the distal two phalanges of the second and third fingers.

Figure 18, A13. Shows typical loss of both median and ulnar areas.

In the examination of ulnar nerve injuries there have been several interesting points.

Figure 19, A4, Lance Corporal S., shows typical ulnar loss to cotton-wool and pin-prick.

In this series of ulnar cases we have been unable to find that the site of the lesion, whether above or below the elbow, has any influence on the relative proportion of the areas lost to cotton-wool and pin-prick. In some, loss to pin-prick extends over nearly as large an area as the loss to cotton-wool; in others it extended only over the phalanges of the fifth finger.

The areas, however, are constant for each individual, varying only slightly from time to time, so that the shrinking of the borders of pin-prick, when compared with previous charts, may in each case be taken as an index of beginning recovery.

In two cases, the posterior cutaneous division of the ulnar nerve escaped injury. In both of these the sensory loss was very striking in that it showed that the anterior division supplied an area on the dorsum of the fourth and fifth fingers much like the distribution of the median, i.e., by lapping back on to the dorsum of the two distal phalanges (Fig. 20, A45. Sergt. T. and Fig. 21, A65, Pte. M.). The proximal phalanx and the ulnar portion of the dorsum of the hand were supplied by the posterior division of the ulnar.

Again, in this case, although the ulnar nerve was involved above the elbow, there was cotton-wool loss only in a small area on the mesial surface of the fifth metacarpal bone (Fig. 22, A20, Pte. J.).

In this area extreme degrees were appreciated as moderate, and pin-prick was everywhere felt. In the remaining portion of the usual ulnar area cotton-wool was everywhere appreciated yet moderate degrees were lost.

One finds it rather difficult at times to determine whether or not there is any paralysis of the interossei for, as has been long taught, there are very few movements for which one muscle alone is responsible. The common extensors aid greatly in separating the fingers when in the extended position (see Figs. 23 and 24, A12, Corporal D.).

These pictures show a case of ulnar paralysis, yet the separation of the fingers, from first appearances might lead one to infer that the interossei had escaped. However, now if the fingers be flexed at a right angle at the metacarpal phalangeal joint and the wrist be kept straight the patient is totally unable to separate the fingers, and paralysis of the interossei becomes at once apparent. Care should be taken that the wrist is straight, and the patient should be told to attempt to open the fingers without much effort. If considerable effort is used the patient uses the extensors even in this position. For all clinical purposes this method demonstrates readily if there is any true paralysis of the interossei or not.

In order to show that the extensors are not essential to separation with the fingers in this position, I have chosen a case of paralysis of all the extensors of the wrist, fingers, and thumb, in which the ulnar nerve is intact. Figure 25, A46, Pte., S, musculospiral nerve shows the very marked degree of separation which, with the common extensors thrown

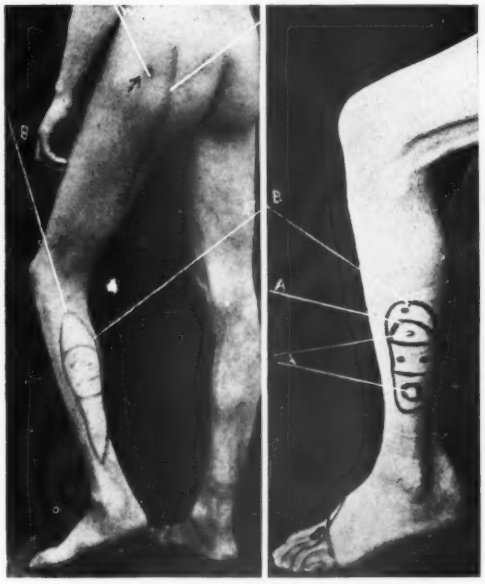


Fig. 27a (left). A23. Sciatic nerve paralysis five months after operation, shows beginning contraction of borders of loss of sensation. Note that on the lateral surface of the foot there is no sensation. *A*, Boundary of pin-prick area; *B*, boundary of cotton-wool area; *O*, operative scar; *W*, wound of entrance.

Fig. 27b. Same case as Fig. 27a, seven months after operation. Shows still more marked contraction of borders of loss of sensation. *A*, Boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, extreme degrees lost only in a small portion of pin-prick area; moderate degrees in remainder of both cotton-wool and pin-prick areas.

out, due to paralysis, can be accomplished by the interossei alone.

Injury to the sciatic nerve, even though extremely high in its course, causes surprisingly little actual disability providing foot-drop is prevented by any one of the numerous devices used for that purpose. In our cases of sciatic injury there was never any paralysis of the hamstrings, even though the injury was extremely high, in two instances, in one at the sciatic notch; paralysis did occur in all the muscles below the knee. The sensory loss in these cases is more or less typical and showed no noteworthy variations.

A35. Capt. B. Third Argyll and Sutherland Highlanders. Bullet wound at 60 yards, May 2, 1915. Entrance: Over middle and anterior portion of left thigh on superior aspect. Exit: Posteriorly, on posterior aspect 2 inches from perineum. Entrance again on right thigh at same level and exit just below gluteal fold on right side. Left sciatic nerve severed.

Fig. 27c. Same case as Fig. 27a and b. Seven months after operation. Shows still more marked contraction of borders of loss of sensation. In Fig. 27a, there was loss of sensation over entire sole., here only over a small part. *A*, Boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, boundaries of cotton-wool and pin-prick areas here co-terminus.

Immediately after injury the patient felt that he had been "slammed on his tail" and he fell forward. He thought at the same time that his foot had been injured, although there was no injury to foot. He felt something wrong but had no unusual sensory disturbances.

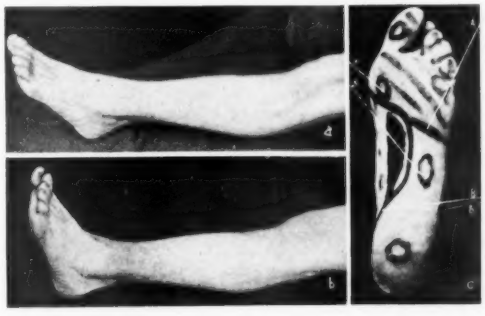


Fig. 28a (above). A3. Sciatic nerve paralysis, eleven months after injury. Note marked plantarflexion of foot. In this case return of function with complete loss of sensation still persists in the sole of the foot. *b*, Same as above showing dorsiflexion. *c*, Showing boundaries of sensation on sole of foot, same case in pictures at left. *A*, boundary of pin-prick area; *B*, boundary of cotton-wool area; *X*, extreme degrees lost in both cotton-wool and pin-prick areas.

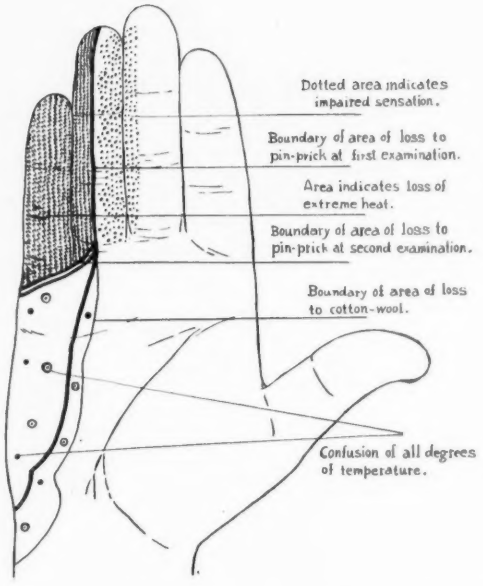

Dotted area indicates impaired sensation.
Boundary of area of loss to pin-prick at first examination.
Area indicates loss of extreme heat.
Boundary of area of loss to pin-prick at second examination.
Boundary of area of loss to cotton-wool.
Confusion of all degrees of temperature.

Fig. 29. Chart 8a. Ulnar nerve. Faint line indicates boundary of loss sensation to cotton-wool. The dotted area on adjacent surfaces of fourth and fifth indicates impaired sensation. Heavy line indicates boundary of loss to pin-prick at first examination. Double heavy line indicates boundary of loss at second examination showing shrinkage. The wavy line area shows loss of extreme degrees. This at one time extended to boundary of pin-prick area. In the pin-prick and cotton-wool areas there is still confusion of both moderate and extreme degrees indicated by large dots and circles.

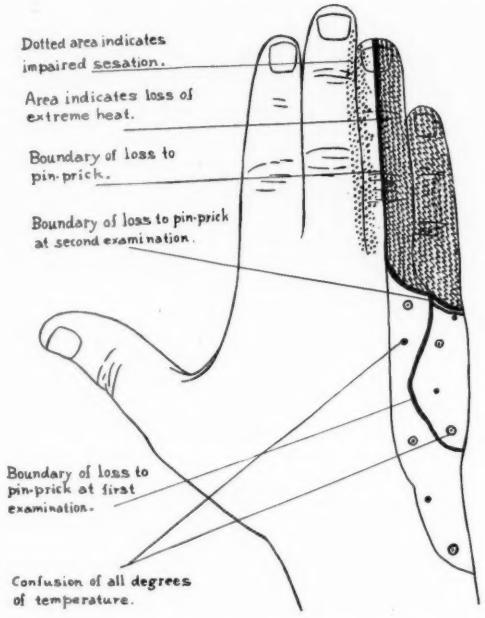

Dotted area indicates impaired sesation.
Area indicates loss of extreme heat.
Boundary of loss to pin-prick.
Boundary of loss to pin-prick at second examination.
Boundary of loss to pin-prick at first examination.
Confusion of all degrees of temperature.

Fig. 29. Chart 8b. See description of Fig. 29, Chart 8a.

There was marked wasting of the muscles of the lower leg. The patient was able to flex and extend leg on thigh. All muscles of the leg, ankle, and toes were completely paralyzed. Eversion and inversion were impossible.

Ten days after injury the patient noticed that the skin on the outside of the leg and foot began to scale. This has happened about five times since injury. Sensory showed that loss to cotton-wool begins about 3 centimeters below the head of the fibula, behind it, and extends obliquely down, crossing in front of the foot at the base of the first metatarsal, thence to its head on the inside of the foot, and skirting the sole of the foot, passes on to the mesial side of the heel 5 centimeters behind the external malleolus, thence upward essentially in the median-line posteriorly to join the point whence we started.

Surrounding the apex of this area about 2 centimeters below the head of the fibula, there is an indefinite area where extreme heat and cold are lost. Cotton-wool is appreciated, but sensation is somewhat impaired and boundaries of this are not definite (See Fig. 26, A35, Capt. B.).

In no instance was the sciatic nerve completely divided, though secondary involvement by scar tissue was usually excessive. A peculiar coincidence was that when the sciatic nerve was partially implicated the portion going to make up the external popliteal was the part involved, and in no instance have we had the internal popliteal alone injured, either when the sciatic was involved, or by wounds below the knee, whereas the external popliteal was wounded four times at or below the knee and partially involved high up twice.

There is one peculiarity which we have found in each of our four cases; i.e., an area forming the cap over the upper border of loss to cotton-wool where there is an indefinite area with loss or impairment to cotton-wool and in which either moderate or extreme degrees may be lost. This area has no definite borders and the loss of sensation is inconstant.

Fig. 30. A37. Incomplete median nerve. Note desquamation which in this case was preceded by a series of herpetic blisters.

Fig. 31. A66. Sciatic nerve. Ulcer at base of fifth metacarpal bone due to scalding water. No pain felt at time of injury or after.

In the following pictures the borders of loss of sensation indicate a beginning regeneration. Figure 27a was taken five months after operation and shows already a beginning contraction for there is no loss of sensation extending on to the lateral side of foot. Figure 27b, taken two months, later shows contraction of borders and the relatively small area where extreme degrees are lost, moderate degrees only being lost in the upper half of the cotton-wool and pin-prick areas.

The picture of the sole, Figure 27c, shows also beginning contraction of the borders which at first included the entire surface of the sole.

One still finds references to immediate return of function after suture — so-called primary union. This term implies that by union of divided ends of nerves conductivity of nerve impulse is again established without degeneration of the peripheral end. Whatever may be one's view of peripheral nerve regeneration, careful clinical observation of sutured nerves has not supported the theory of primary union of divided nerves. The usual test which the surgeon makes is to touch the area in question with his finger, involving in most instances deep sensibility which may never have been lost. Careful qualitative testing and accurate charts must be made before and after operation. In all cases I have gone over carefully with cotton-wool, pin-prick, and both moderate and extreme degrees, and in no single instance has there been any immediate return of any form of sensation.

Return of function varies with the site of the lesion, the nerve involved, and the nature of the wound as well as the distance of the lesion from the periphery. The nearer the lesion to the periphery the earlier the return of motor function. This does not hold true for sensory disturbances. Those muscles supplied the nearer to the lesion regain their function the sooner. For example:

Fig. 32.

Fig. 33.

Fig. 34.

Fig. 32. A36. Ulnar nerve lesion showing healing burn on fifth finger. Patient felt nothing at the time of injury.

Fig. 33. A19. Fresh ulcer and one on dorsum of fifth finger. No pain felt at time of injury.

Fig. 34. A18. Median nerve. Scald of all four fingers. The nails of the fingers supplied by the median nerve came off, leaving a raw surface, which, however, healed eventually.

A51. Corporal D. Third Northumberland Fusiliers. Wounded by bullet, May 25, 1915, at 50 yards range. Entrance: over the sternal portion of the clavicle, having traversed the axilla. Exit: posteriorly, on border of latissimus dorsi on the posterior axillary wall. No fracture; no great vessels injured; no sepsis; scars free. Immediately after injury the whole arm felt "limp and numb." The patient says that he had no feeling anywhere in his arm, on any of its surfaces. There was complete paralysis of the musculospiral muscles including triceps, supinator longus, wrist-drop, etc. He was treated at first conservatively with electricity, massage, etc. On August 20, 1915, exploration showed the posterior cord involved in a mass of scar tissue. It was freed and the whole wrapped in Cargile membrane. About the middle of November, six months after injury and three months after operation, he could voluntarily extend the flexed arm, and about one month after that he found that he could supinate and extend the wrist. Extensors of thumb and fingers still do not contract. There was no sensory loss of any kind, either to cotton-wool pin-prick, or moderate and extreme degrees, nor was there any confusion of degrees in any area to be made out.

From this it will be seen that the return of motor function began from above downward, beginning with the triceps, then supinator longus, and then the extensors of wrist.

In some cases there has been a return of motor function before any change in sensation either to cotton-wool or to pin-prick. This, however, is the exception. Changes in sensation, particularly to pin-prick (loss to extreme degrees persists longer, even after all sensation to pin-prick has returned), usually precedes return of motor function.

The following case shows the return of motor function with little or no change in sensation:

A3. Pte. M. Fourth Worcesters. Wounded at Dardanelles, April 28, 1915. Bullet wound of left leg. Entrance: just in front of biceps tendon, two inches above its insertion. Exit: internal surface of thigh anterior to semi-membranosus. Fracture of femur in other leg.

Three months later, when he began to walk the patient first noticed that he was unable to use his left leg, and that sensation on the sole of the foot was completely lost. There was complete paralysis of all the muscles below the knee. In view of the general condition it was decided not to operate. On March 17, 1916, the patient showed considerable improvement. He was able to dorsiflex and plantarflex the ankle with considerable power against resistance, and there was slight return of plantarflexion of toes (see Fig. 28a). Circumduction of foot was readily performed. At this examination there was no loss of sensation on the lateral surface of the leg, return having been complete, even to cotton-wool, which usually persists a longer time than any other. On the sole of foot, see Fig. 28c, however, all forms of sensation were absent to cotton wool, pin-prick, and extreme degrees.

The following case shows the return of sensation to pin-prick yet confusion to extreme degrees persisting in part of area:

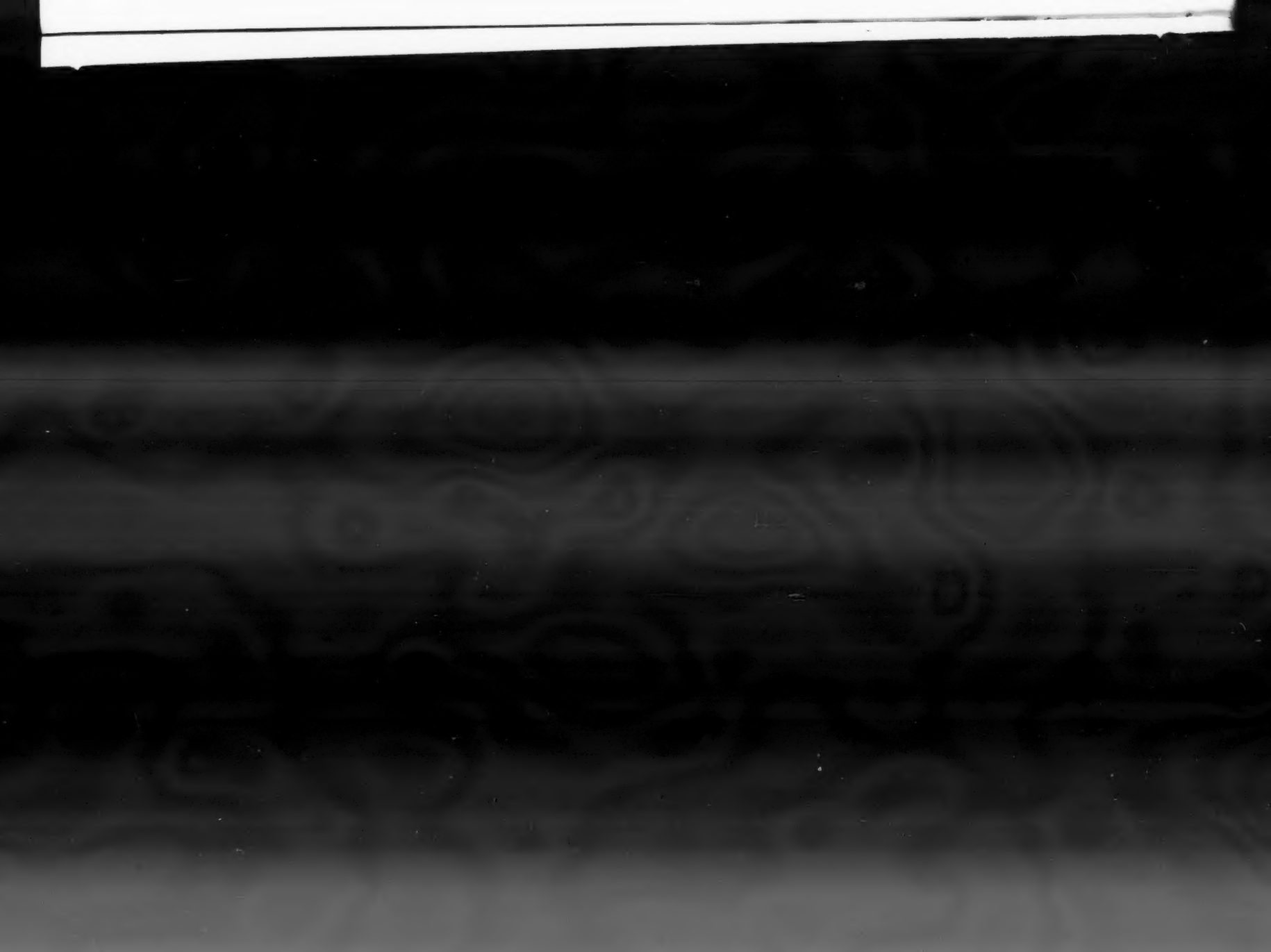
A29. Pte. H. Fifth Lancashire Fusiliers. Ulnar nerve. Bullet wound, August 7, 1915, range about 6 yards. Entrance: flexor surface of forearm two and a half inches above wrist over line of ulna. Exit: same level, posteriorly, with compound fracture of ulna.

One month after injury the patient noticed sensation of "pins and needles" in hand. There is some desquamation over hypothenar eminence, which extends on to the fifth and half of fourth finger, more especially on the adjacent surfaces. Hand becomes blue and cyanotic and patient complains that it is persistently cold.

Loss to cotton-wool, beginning at the tip of styloid process, extending in axis of third finger across back of hand, and on to ulnar side of fourth finger; remaining part and adjacent side of fourth show impairment to cotton-wool. On front of hand, running across thenar eminence, striking it at the small fold of skin, and running in axis of fourth finger, there is complete loss to cotton-wool. Running from base of fourth finger about a quarter of an inch from border of cotton wool across styloid process, half an inch from it, and skirting border of cotton-wool area on dorsum to base of fourth finger, is boundary of pin-prick. Over both light touch and pin-prick areas extreme cold confused; at 13° invariably called hot; heat described as such. Over both surfaces of fifth finger all temperatures absolutely lost. Deep sensibility lost in fifth finger and adjacent side of fourth, and corresponds very closely with area of loss to extreme degrees (see Figs. 29 a and b, Charts 8a and b).

Trophic changes have been rare in this series of cases. The only trophic changes in the skin have been herpetic blisters, in one case along the line of the external cutaneous of the musculospiral nerve and the other in the palm of the hand in a case of median nerve injury. In this latter case the area of distribution did not correspond closely to the median supply.

In most cases there occurred some time after the lesion considerable desquamation of the skin of the affected part. This in some repeated itself two or three times (Fig. 30, A37. Lance. Corporal M. Median nerve).



The skin frequently shows small red papules following examination with pin-prick much like the raised wheal in neurotic individuals. These persist for 24 to 48 hours. The skin in the pin-prick area bleeds more readily than elsewhere following the prick with the examining needle.

I have seen no case of true trophic ulcers; they were the result of trauma to the skin, insensitive to painful stimuli, the most frequent causes being burns and scalds from cigarettes, hot water pipes, and hot water. These ulcers and burns heal readily and show no variation in their mode of repair from that found in other parts. (Fig. 32, A36. Pte. S. Ulnar nerve.) This picture shows a healing ulcer caused by patient holding hand against hot water pipe.

Figure 33, A19, Pte. W., ulnar nerve, shows both recent burns due to hot water pipe and an older one due to a cigarette.

In both of these cases the patients felt nothing and only realized their injury when wound was seen.

Figure 31, A66, Pte. M., complete sciatic nerve, ordinary, shows ulcer on foot due to hot water.

Changes in nails were frequent. Most often the patients complain that they were brittle and harder, and that epithelium collected under the free border. In no instance were nails lost without any previous injury. It is true that their resistance is lowered and that the same injury caused greater damage than to normal nails. This is well illustrated in the following case (see Fig. 34, A18, Lance Corporal P., in whom the median nerve was severed): All four fingers were placed in scalding hot water. The nails of those fingers having median supply came off leaving a raw surface, which, however, healed uneventfully. The nails of the two other fingers did not come off, even though they too had received the same degree of trauma.

Functional disorders while relatively frequent in the general wards were found in but two of these cases of gunshot wounds of peripheral nerves. In each instance a functional disorder was superimposed on an organic lesion. In combined injury to two or more nerves the hysterical element becomes more difficult to differentiate. The diagnosis, however, is not difficult if the condition be borne in mind. The paralysis is of the flaccid type, and involves more muscles than could be accounted for by any one or probable combination of nerve injuries. The most typical manifestation of these functional disorders is the nature of the anæsthesia and its distribution. In both these cases there was total anæsthesia, i.e., loss to cotton-wool, pin-prick, and deep pressure. Such total loss is never found in any peripheral nerve lesion. In one case the anæsthesia was of the circular, stocking type.

In the other case even though the organic lesion was a severed musculospiral nerve in its middle third, anæsthesia extended on to the back, neck, and on to the opposite shoulder and neck. Patient did not feel a needle which transfixed the skin over the shoulder in area supplied by the acromial branches of the cervical nerves.

I wish to express my very deep gratitude to Lieutenant-Colonel Robert Jones, at whose suggestion this work was undertaken, and for the many kindnesses he has shown me, and the interest he has taken in the work.

I also wish to thank Captain Armour and Captain McMurray for their generosity in turning their cases over to me and for the many helpful suggestions they have given.

I am indebted to Mr. Shepherd, vice-president of the Photographic Society, for many of the pictures which are so well done.

CONCLUSIONS

1. With the use of high explosives and bullets with high velocity the frequency of nerve lesions has increased.

2. Peripheral nerves may be injured by direct violence of projectile and by the violence imparted to bits of bone or even foreign bodies.

3. Peripheral nerves may be implicated secondarily by scar tissue, or callus, or both.

4. Diagnosis cannot be made before operation between anatomical and physiological division. Diagnosis can usually be made in cases with incomplete division.

5. In war surgery primary suture is rarely possible due to infection.

6. Exploratory operation is indicated when a diagnosis of complete division is made. Delay in operating usually means delay in return of function.

7. Nerve-freeing is in many cases to be preferred to excision and suture. When the nerve is widely implicated and there is a large loss of continuity, it is better to do nerve transference or nerve transplantation than tubulization or suture with the nerve under tension.

8. Stretching of the nerve should not be done, as it causes karyolysis of the nerve cells in the anterior horn with subsequent degeneration of the nerve axon in the proximal nerve-trunk.

9. Efficient splinting to prevent contractures and overstretching of the muscles is imperative, both before and after operation.

10. The terms epicritic and protopathic tend to be confusing. Greater accuracy in use of specific terms as, area of cotton-wool, area of pin-prick, areas of moderate and extreme degrees.

11. Musculospiral nerve injured in its lower third does show loss of sensation on narrow band over dorsum of thumb, usually only loss to cotton-wool and temperature sense.

12. Injury to musculospiral nerve may cause dissociation of temperature sense in the area on the dorsum of the hand — without loss to cotton-wool.

13. The median nerve does not supply any skin on the dorsum of the thumb; supplies up to line in continuation of lateral borders of nail.

14. The anterior cutaneous division of the ulnar nerve supplies the skin in the same manner as does the median nerve, i.e., on to dorsum of fifth and part of fourth, middle and distal phalanges. The posterior cutaneous division supplies the ulnar side of the hand and the proximal phalanx of the fifth and part of the fourth.

15. The action of extensors assists the interossei in separating the fingers. To test for paralysis of the interossei have the patient bend his fingers at right angles at metacarpal phalangeal joints; prevent effort of extensors by holding the fingers across; then have the patient try to separate his fingers gently.

16. Return of motor function begins with the muscles which first receive their supply below the lesion. The return is earlier the nearer the lesion is to the periphery.

17. Trophic ulcers occur only after trauma. Their repair appears to be no different than that in other parts.

18. Functional disorders may be superimposed on organic peripheral nerve lesions. Usually they are readily recognized.

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DIAGNOSIS AND MANAGEMENT OF ACUTE EXTRAPELVIC CONDITIONS DURING PREGNANCY[1]

By E. WYLLYS ANDREWS, M.D., F.A.C.S., Chicago

SURGEONS can contribute nothing to our knowledge of pregnancy itself, but perhaps they can contribute a few sidelights of certain mixed problems of surgery and the puerperium. These include accidents and injuries in the pregnant, emergencies or urgent surgery, questions of time of interference in surgical diseases of women, and the serology and laboratory tests for surgical affections as modified or vitiated by pregnancy.

Problems are constantly occurring in our work which could easily be solved by a conference between a surgeon and an obstetrician, but which I find are not so easily settled by merely asking the advice of an obstetric specialist. When to operate or whether to operate for an appendicitis that is latent, whether such an interference should be late or early in the pregnant, whether it is more dangerous to leave such conditions untouched, or to risk the termination of gestation — these are all problems upon which I find no two specialists agree, either as to the fundamental principles or individual cases.

This leads me to think that some such questions may be insoluble by scientific deductions or collected experience and that I am making unjust demands for information that does not exist as yet in undisputed form. Plainly this is because too many elements enter into the problem to make a simple solution possible.

One authority considers the problem most of all from the standpoint of the mother, another observer considers first of all the welfare of the unborn child, and these different standpoints make it difficult to arrange our premises so as to arrive always at the same conclusion. Even if the science of midwifery has not settled all doubtful points, the obstetrician should have decisive authority and the general surgeon should feel his limitations very narrowly. I believe the obstetrician should be the dictator, and that his judgment should override that of the surgeon in borderline cases.

This may be an exacting and impossible standard in a field where no standards have been developed; but if in the obstetric field standards are still undeveloped, in the surgical field they are wholly wanting in all matters which concern the puerperium.

The extrapelvic surgical conditions during gestation which may confront the general surgeon may be grouped as—

1. Injuries and accidents of all kinds: fractures; contusions; wounds, internal and external.

2. Surgical abnormalities, infections, abscesses, and mycoses of various abdominal organs, chest, neck, brain, or extremities.

3. Associated problems of the ductless glands and their metabolism during pregnancy, including the problems of serology and diagnosis as altered or vitiated by pregnancy.

1. In traumatic emergencies during pregnancy an absolute indication may be present for saving the life of the mother. Also in certain other emergencies, such as strangulated hernia where no choice of methods exists, there is in a sense no problem created by the fact of gestation, inasmuch as we must either operate or lose the patient; but even here our mode of operating, or choice of anæsthetics, and our management before and after operation may be modified by the pregnancy. It has been our frequent experience that women with fractures, wounds, contusions, or any form of trauma are continually appearing in the surgical ward. If treated in the routine way with no precautions to avoid shock or uræmia from prolonged operating or long anæsthesia not of themselves dangerous, we find that these yield too large a percentage of abortions and too often a fatal ending for the mother; whereas, if we minimize these surgical procedures as to time and severity, and choose

[1]Read before the joint meeting of the Chicago Gynecological and Chicago Surgical Societies, May 20, 1916. (See discussion, p. 750.)

carefully the time of election, we may carry the majority of them through without terminating gestation. The choice then would lie not always between operation and no operation, but between a major and a minor or palliative measure.

2. Surgical diseases non-traumatic must be treated upon the same general principles. I allude to such affections as become surgical emergencies: appendicitis, gall-stones, gastric ulcer, tuberculous peritonitis, hydronephrosis, kidney-stone, newly discovered carcinoma, brain or spinal tumor, etc., etc. Here again the surgeon's principle should be to do no operation during pregnancy which can properly be postponed, but again after conference with the obstetrician to do whatever is necessary for the safety of the mother. Each case of surgery in the pregnant is to be decided on its own merits. We are engaged in treating not diseases, but sick women, or, in each instance a sick woman. Every element in the life history and physical condition of that patient must be used in making the decision on that particular case. In other words, the mother's condition is the deciding point. Armstrong in discussing this problem lays great stress on a careful study on the gastro-intestinal and liver functions. Contradictory results may be obtained from small series of statistics. W. W. Keen performed a hip-joint operation for sarcoma in the fifth month of gestation, followed by recovery and normal full-term delivery. On the other hand, Armstrong performed an interscapular thoracic amputation for sarcoma with a pregnancy of six months with little loss of blood or shock, gestation being interrupted on the third day, but the patient recovering. We must be cautious not to draw conclusions from small series of cases in our own clinic or the clinics of others.

We sometimes see the term "surgery of the puerperium." I should prefer to use the expression, "surgery as related to the puerperium," or "surgery in spite of the puerperal state." It is true also that a few doubtful procedures as decapsulation of the kidney have been advised directly for the puerperal state. I have never done decapsulation of the kidney for eclampsia, although I am not a total disbeliever in its occasional value in acute renal congestion. From conferences with men whose judgment count for most, I incline to the opinion that this procedure is seldom effective unless in sudden anuria, and that those observers are more nearly right who ascribe a liver and gastro-intestinal origin to eclampsia.

I do not know whether a dystopic kidney is an extrapelvic condition, but its occurrence in pregnancy and parturition is a grave problem. An argument for routine fixation by nephropexy in all women who might become pregnant would seem absurd to most surgeons who know that unsatisfactory cures are common, yet Straeker and others urge that all such cases demand nephropexy if discovered early, and assert that delivery cannot take place without danger to mother and child. They even advise craniotomy or cæsarean section according to whether the child is living or dead. More rational is the advice of Walker who believes that delivery can generally take place without operative interference.

A word might be said in regard to certain affections of the extremities, as varix or varicose ulcer of the leg, directly produced or aggravated by childbirth. These present no real problems, except as to diagnosis and prognosis, if we agree upon the fundamental principle of non-operative treatment of pregnant women. Of course all other forms of treatment have full play in these and allied conditions.

3. Problems in serology, metabolism, and disturbances of the ductless glands are extremely important and interesting, but more from the standpoint of diagnosis than of surgical interference. It is well known that the hypophysis has an interaction with the sex organs in pregnancy. This has been noted by Mareck, Bland-Sutton, and others, and the observation has been many times confirmed. Temporary acromegaly is seen not infrequently. In one case cited, aged 28, the gloves and shoes became too tight and the rings had to be cut from the fingers. The features become coarse, the patient was sleepy and had glycosuria, but recovered. Also, eye symptoms occur from pressure of

the enlarged hypophysis. Lewis and Kanavel, both of this Society, state that the relation between the hypophysis and organs of generation is constant and that amenorrhœa may be due to an early stage of hypophysis disease. Reuss, also Stoome and others think it is almost physiological to have slight degrees of thickening of fingers, nose, or face from hypophyseal irritation in pregnancy.

The importance of this and other ductless-gland disturbances, which I shall mention next, lies mainly in its diagnostic importance. In other words, the presence or absence of pregnancy might have a very important bearing on the diagnosis and prognosis of early cases of hypophyseal trouble.

Similarly the Aberhalden test, which was first used in the diagnosis of pregnancy, is now employed in many other conditions, as carcinoma and systemic diseases. It is hardly necessary to emphasize the fact that it would be valueless for such purposes if pregnancy were concurrently present.

Another disturbance of the ductless glands is brought about by some interaction between the gravid uterus and the parathyroids. Haberfeld, in 1907, from the material in Shauta's Clinic in Vienna, was able to demonstrate distinct atrophy of the parathyroids in patients who had tetany. His microphotographs prove definitely the atrophy in all four parathyroids, in cases of so-called tetania gravidarium. In other words, there is a hypoparathyroidism.

I have been interested to notice that the presence of pregnancy causes a marked delay in the phthalein test. In the last months of pregnancy the appearance was delayed 14.6 minutes, in an average of ten cases, as compared with 5 or 10 minutes in non-pregnant women. The average percentage in 2 hours was 47.93, as compared with about 60 per cent in an average person. As such a marked decrease would point to a chronic interstitial nephritis, except in the pregnant, allowance must be made for this factor in using the test.

An important surgical problem, and I may say sometimes an acute emergency, is that of syphilis in the puerperium. For diagnosis the Wassermann reaction must be accepted as less conclusive than in non-pregnant women. It is variable and inconstant, as is also the affect of salvarsan. I am certain that after five or six injections of neo-salvarsan or salvarsan the reaction may remain positive. Salvarsan may also terminate gestation, especially near term. In the only statistics I have at hand, those of Marshall, this occurred three times in 84 treatments, 3.5 per cent. On the other hand, we do not know but that the treatment may have benefited, since of these 84 treated, 38 went to full term, 32 were in the ninth month, and 12 in the eighth month. Ninety-two per cent were born living of syphilitic mothers, which also shows that salvarsan protects the life of the fœtus.

There is some basis for the theory that a toxin is liberated directly in the blood by action of arsenic and the spirochetæ. Arsenic can only be eliminated by healthy organs; liver and kidneys. High blood-pressure and hypertension in pregnant women should warn us against both neo-salvarsan and salvarsan, especially the latter which is excreted more rapidly. As the liver and especially the kidney are so liable to damage in the puerperium, we must emphasize the dangers of salvarsan. Albuminuria may be intense after average doses, but will disappear after careful diet. The drug should not be given to pregnant women when careful urinalysis foreshadows such accidents. Jaeger, Bar, and Gaucher have reported fatal cases from its use. In the Fifteenth Congress of the French Obstetrical Society, Sauvate reported 130 cases of syphilitic women treated by modern methods, and gave a very careful analysis of the end-results.

I can give no better summary of the surgeon's standpoint, which in reality should rest upon what he has been taught by the obstetrician, than to repeat the rules laid down by Raeder:

1. Women expecting to be pregnant should be given a thorough physical examination.
2. Every functional defect should be corrected before pregnancy.
3. No operation which can be deferred should be performed during pregnancy.
4. Any operation which will contribute to the safety of the patient should be performed.

DIAGNOSIS AND MANAGEMENT OF PREGNANCY IN THE PRESENCE OF ACUTE ABDOMINAL CONDITIONS[1]

By JOSEPH B. DE LEE, M.D., F.A.C.S., Chicago

AS I understand it, my part in this symposium is to discuss the diagnosis and management of pregnancy in relation to acute abdominal conditions. Others will discuss the diagnosis and management of acute abdominal conditions complicated by pregnancy.

Very little need be said regarding the diagnosis of pregnancy in the presence of acute abdominal conditions. This does not differ from the regular diagnosis of pregnancy. There are several acute abdominal conditions where the differential diagnosis must be made between pregnancy and the condition itself; prominently among which is ectopic pregnancy versus appendicitis. Occasionally one will have to make the differential between angular pregnancy and twisted ovarian cyst; acute polyhydramnion and acute ascites; spontaneous rupture of the pregnant uterus and rupture of another abdominal viscus, e. g., the stomach or gall-bladder; pregnancy and acute tubercular peritonitis; pregnancy with hyperemesis and intestinal obstruction; ectopic pregnancy and gall-stones.

I doubt if there is a surgeon or gynecologist of experience in the room who has not opened the abdomen for appendicitis and has found a ruptured eccyesis, or conversely. An ectopic pregnancy can give all the symptoms and signs of appendicitis — pain, vomiting, tympany, fever, leucocytosis, abdominal rigidity, etc. A positive Abderhalden reaction would help in the diagnosis if there were time to wait for it. Leucocytosis does not give reliable information because physiologically there is a marked leucocytosis in pregnancy. A rising leucocyte count, however, taken every two hours, has a great deal of significance, especially if there is at the same time an undiminished hæmoglobin index.

Most difficult and often impossible is the diagnosis when extra-uterine pregnancy and appendicitis coexist, or when extra-uterine pregnancy and tubercular salpingitis coexist.

Appendicitis versus	Ectopic Gestation
1. No signs or symptoms of pregnancy.	1. Present.
2. Pain, nausea and vomiting, fever.	2. Pain worse, vomiting less, fever absent or less.
3. Tenderness and rigidity high up.	3. Tenderness and rigidity much less and low down.
4. Leucocytosis usual, and increases from hour to hour. Normal hæmoglobin.	4. Leucocytosis equivocal. The blood-count shows increase of the polymorphonuclears and mononuclears, the basophiles with the signs of secondary anæmia. Low hæmoglobin.
5. Patient flushed and excited. At very beginning there may have been a little dizziness.	5. Pale and faint or apathetic.
6. Uterus and adnexa normal.	6. The characteristic findings.
7. Feel a tumor high up in pelvis.	7. Tumor low in pelvis.
8. No uterine symptoms.	8. Menstruation atypical and discharge of decidua.
9. Abderhalden test usually negative.	9. Abderhalden test positive

Regarding the other conditions mentioned, the differential diagnosis is not so difficult if but the possibility of their existence be borne in mind. For example, one might think that it would be impossible to confound hyperemesis gravidarum with obstruction of the bowels and yet recently this error cost a woman her life. The diagnosis would have been made had the attendant possessed obstetric eyes on his finger tips. Again, who would place together for diagnosis, gall-stones with obstructive jaundice and ectopic pregnancy in the left tube? A woman had pain in the region of the gall-bladder, rigidity of the upper right rectus, icterus, nausea, and vomiting. A soft mass at the left of the uterus with the menstrual history were sufficient to demand opening the lower abdomen. A two months' fœtus had escaped from the left tube. There had been no pain in the lower part of the abdomen; all symptoms had been referred to the right hypochondrium.

More important for the purposes of this particular part of the symposium is the *treatment of pregnancy* in the presence of acute abdominal conditions.

I can dismiss ectopic gestation with a few words. I believe it is best to open the abdomen in practically all cases of eccyesis and remove the products of conception. In rare instances where a hæmatoma is very old and absolutely quiescent, one may await its

[1] Read before the joint meeting of the Chicago Gynecological and Chicago Surgical Societies, May 26, 1916. (See discussion, p. 750.)

spontaneous absorption, and when the mass has become infected one should drain from below; otherwise my practice is laparotomy when the diagnosis is made.

The other acute abdominal conditions which I will discuss are: appendicitis and pregnancy, salpingitis, cholecystitis, gallstones, ileus, pyelitis, rupture of the uterus, perforation of the uterus, hernia.

Greatest interest attaches to the appendicitis because it is the most common and has a very high mortality. Two points in the diagnosis I wish to lay emphasis upon; first, the possibility of confusion with pyeloureteritis, which is so common during gestation. Another point is the frequency of a syndrome named by Bar, "colibacillose gravidique." In these cases the patient has symptoms of ureteritis, appendicitis, and cholecystitis, all at once, and the colon bacillus is found in the urine. Two of my patients had, in addition, jaundice, which rendered the diagnosis very difficult.

Now, as to the management of pregnancy in cases of appendicitis I may say, that this depends on the treatment of the complication. If a woman has only a history of appendiceal attacks, I usually do not recommend operation during pregnancy. Without question the best treatment of acute appendicitis is immediate operation, and if possible, removal of the organ. The incision must be made higher and further in the flank, the more advanced in pregnancy the woman is found to be. Every effort should be made to reduce the amount of handling of the uterus, and if drains are inserted, they should not impinge on the uterus if at all avoidable. Morphine in large doses should be given after operation in order to prevent abortion or premature labor. If uterine action supervenes the labor must be conducted with a minimum of disturbance of the uterus. Newly formed pericæcal and peri-uterine adhesions may not be broken, which means that one should try to get nature to empty the uterus without the necessity of manual or instrumental invasion of its cavity. In abortions the tampon should be used, and if necessary the curette, which by proper manipulation will move the uterus around less than manual curage. Unfortunately it is often necessary to clean out the uterus because the organ, usually inflamed, cannot empty itself. In such cases spreading of the pus by breaking protective adhesions is almost inevitable, and may be the direct cause of death. To avoid this accident Kroenig recommends the following for suppurative appendicitis: opening, draining, and walling off the abscess; delivery from below by vaginal cæsarean section; inspection of the abdominal contents and renewed walling off of any part disturbed by the vaginal delivery.

If abortion is impending at the time of operation, the uterus should be emptied first, then the abdomen opened. If the woman is at term cæsarean section had best not be done (unless there are other indications for it), but the appendicitis should be treated and then large doses of opium given in the hope that labor will not supervene until the adhesions are very firm and the pus nearly all drained out. If a cæsarean section is done in the presence of a general peritonitis, the uterus had better be removed and the whole pelvis widely drained from below. This advice has been questioned by other authors. My reasons for advocating hysterectomy in the presence of infection are (1) that by removing the uterus we get rid of a large organ in the process of molecular disintegration. A uterus undergoing involution is really a necrosing organ, and a favorable soil for infection. (2) We eliminate large venous plexus that are very prone to become infected. (3) We are enabled to drain the pelvis widely from below. Opponents of this practice say that by opening up the lymphatics in the pelvis we increase the dangers of absorption of bacteria and toxins; that in appendicitis cases the peritoneum can care for larger amounts of infective material than the connective tissue, and the woman suffers a severe mutilation and it may not have been necessary. Only a large experience will settle this point. One thing is certain. When the cæsareanized uterus is left in the abdomen in the presence of infection the patient is critically endangered.

Salpingitis. Acute inflammation of the fallopian tubes is rare during pregnancy. The diagnosis is very difficult, one usually

thinks it an appendicitis, and opens the abdomen for that. Contrary to the treatment outside of pregnancy, salpingectomy is recommended in these cases, to prevent rupture during labor and infection during the puerperium. The management of the pregnancy and labor is the same as that given under appendicitis.

Cholecystitis. Here the pregnancy requires no special care. Should labor come on during an attack of cholecystitis, delivery should be operatively consummated as soon as possible. It is important to prevent bearing-down efforts which might rupture the gall-bladder. In all abdominal manipulations, the region of the gall-bladder should be scrupulously avoided. Chloroform should not be given; it destroys the liver, which is already affected by the inflammation.

Gall-stones. The same treatment of pregnancy and labor as in cholecystitis.

Ileus. Pregnancy itself may cause ileus, by stretching an adherent coil or knuckle of gut, or tightening an old adhesion around it. In such cases emptying the uterus will relieve the obstruction. If ileus occurs before the child is viable, the abdomen had better be opened and the intestine freed. After viability, the uterus should be emptied from below and if this does not at once remove the trouble, laparotomy is indicated.

The above has reference to mechanical ileus, not to that due to peritonitis, paralysis of the gut, or duodenojejunal closure. Since the differential diagnosis between these various causes cannot always be made it is best as a rule, first, to empty the uterus and then, if improvement remains absent, to open the abdomen. The needful manipulations in the abdomen are much easier made with the child removed.

Peritonitis following ileus in pregnancy and the puerperium is very fatal; therefore early treatment is imperative.

Pyelitis. In the acute ureteropyelitis, it is almost never needful to empty the uterus to effect a cure. Posture in bed, the knee-chest position taken frequently, proper medication and other remedies usually succeed. But occasionally an abscess forms, or pyemic symptoms threaten and the question arises, drainage of the kidney or induced labor? In real renal abscess, drainage is indicated. In pyelitis first an attempt to relieve by ureteral catheterization should be made before inducing labor. The question of the manner of emptying the uterus now comes up. Is it not dangerous to perform so many vaginal manipulations as are required to induce labor, through a field continually bathed by urine infected with virulent bacteria? Experience has shown that it is and it is not. I know of women that died from such infections and again I have had many who were not at all affected. Deaver has done cæsarean section seven times for this indication, and I believe it deserves very respectful consideration. Of course the local immunities may be so well developed that vaginal inoculation by the infected urine is harmless. At all events if there is no other reason for cæsarean section, one will seldom perform it because of the fear of infecting the parturient canal, and during delivery from below extraordinary care should be observed to prevent infected urine from soiling the field. This is not so simple as it seems, and it may be necessary after emptying the bladder, to throw a temporary ligature around the urethra.

Rupture of the uterus during pregnancy requires laparotomy. Perforation of the uterus made during an attempt at criminal abortion also requires immediate laparotomy. The uterus should be emptied through the perforation, enlarged if necessary. Whether or not the uterus should be removed depends on circumstances. If infection is present it is probably better to do a hysterectomy and drain the pelvis widely as was before explained. If the case is presumably clean the uterus may be preserved. If the woman has many children one will have less scruples about removing the uterus. A simple aseptic perforation made by a clean operator requires no treatment except packing.

Abdominal wounds. Injury to the abdominal contents, especially the uterus, requires immediate laparotomy. If the child is alive and still in the uterus (rare) the damage may be repaired. Otherwise the uterus is to be emptied, and sutured, unless infection is present, then hysterectomy and wide drainage.

Hernia. Strangulated hernia is very rare during pregnancy and labor, but various ruptures are not uncommon. Unless the gut is adherent, the growing uterus pushes the contents of the sac out and away from the hernial opening, and makes a temporary cure, but the ring is enlarged by the distraction of its pillars, and the hernia is worse in the puerperium, though incarceration is rare. Adherent gut may be incarcerated, twisted, or stretched even to the production of obstruction. During labor the opening is usually closed by the large uterus, and even during strong bearing-down efforts the rupture does not enlarge. I saw, however, an inguinal hernia develop during strong expulsive effort. Treatment of hernia is the same as at any other time when threatening symptoms occur. During labor it is not wise to allow too strong bearing-down efforts if one sees the hernial tumor enlarging. Forceps should be applied soon after the dilatation is complete. It is not safe to hold the gut back during the strong expulsive straining; it may produce shock. Umbilical and post-operative hernias are usually permanently enlarged by pregnancy, and traction on adherent omentum often causes pain both during pregnancy and labor.

The management of pregnancy in the treatment of hernia requires no special comment. If an ileus results from the stretching of the gut in a hernia, emptying the uterus should first be performed, which failing to cure herniotomy is in order.

Operations during pregnancy. All operations that can be postponed until after delivery should be postponed. Indications for opening the abdomen should be very strict during pregnancy. It may be advisable to empty the uterus as a preliminary measure in certain conditions already mentioned. The large uterus makes the operation more difficult since the intestines are much displaced and rendered inaccessible. The respiration is impeded, especially if the tympany is marked. The vascularity of the tissues is much increased, the kidneys do not stand the anæsthetic, and operative shock as well as usually — all things which render the technique difficult and place the result in doubt.

THE DIAGNOSIS AND MANAGEMENT OF PELVIC AFFECTIONS COMPLICATING PREGNANCY[1]

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WHILE pregnancy is fortunately seldom complicated by acute affections of the organs or tissues of the pelvis, yet there are so many varieties of these affections which may occur that only a few of them can be considered in the limited time at command.

Of affections of the uterus let us consider only retroversio-flexion and rupture. Evil results of backward displacements of the gravid uterus are not common, but, when they do occur, are among the most serious complications of pregnancy. Such displacements are among the commonest of uterine disorders, and pregnancy is not rare in women who have them. In most instances the displaced uterus is spontaneously replaced as it enlarges and ascends into the abdomen. Indeed, it is often unrecognized. Even when the retroplaced uterus is fastened backward by adhesions, gradual traction upon them by the enlarging organ will often separate or stretch them so that the uterus can be spontaneously reduced. In this spontaneous separation of adhesions there will sometimes be enough intraperitoneal hæmorrhage to cause symptoms of acute anæmia. In a few reported cases it has been necessary to open the abdomen in order to check the bleeding.

The diagnosis can be made from reflex vomiting and nausea, from pressure symptoms causing pains in the sacrum and lumbar back,

[1]Read at the joint meeting of the Chicago Gynecological Society and the Chicago Surgical Society, May 26, 1916. (See discussion, p. 750.)

and from symptoms of disturbance of the bladder. The nausea and vomiting may be a return of that which marked the early stages of the pregnancy or an excess of such symptoms, or their increasing severity at the time when they are normally to be expected. In either case, as in any particularly violent gastro-intestinal symptoms in a pregnant woman, a pelvic examination should be made. If retrodisplacement of the gravid uterus is present, it will be detected by feeling the posterior uterine wall or the fundus deep in the cul-de-sac and encroaching upon the posterior wall of the vagina. The portio vaginalis of the cervix and the external os will be found drawn up anteriorly to a position behind the pubes or even higher.

Pains in the sacral and lumbar regions are likely to be noted by the patient, due to crowding of the uterus and pulling upon the adhesions. As the cervix and lower uterine segment are forced upward and forward the anterior vaginal wall is stretched and lengthened, and the base of the bladder, which is attached to both, is also stretched and disturbed. The urethra is stretched, and the bladder is forced upwards into the abdomen. Irritation of the bladder, due to the stretching and pulling of that part of its base which is attached to the uterus and vagina, causes frequent urination and later retention. Marked distention of the bladder so that it reaches far up toward the diaphragm and the so-called ischuria paradoxa are late manifestations, after the incarcerated uterus has completely filled the pelvic cavity or the anterior wall thereof has become thinned and distended as it swells upward into the abdominal cavity.

Usually abortion will take place before the case reaches the severe stage just described. Before it has reached even the stage when abortion is threatened, it should be recognized and treatment should be instituted. Palliative measures are seldom of much avail and should not be allowed to consume much time. In cases where manual attempts to replace the displaced organ without anæsthetic succeed, the same effect could probably have been attained spontaneously. Sometimes manual replacement will succeed under anæsthesia, even when there are a few adhesions binding the uterus backward. This procedure is not unattended with danger and never should be attempted unless patient and doctor are prepared for immediate laparotomy.

Numerous cases are recorded where the gynecologist opened the abdomen, separated adhesions, and reduced the misplaced uterus. Some have even performed ventrosuspension or shortening of the round ligaments after having replaced the uterus. Of course most of the reported cases were successful. My opinion is that such suspensory operations upon the uterus are as unwise as they are unnecessary. If the retroflexed or retroverted uterus can be freed from the retaining adhesions and can be replaced in its normal position, it can be held there by light tamponade or by a soft round pessary for the short time which will elapse before it will be naturally retained above the superior strait on account of its increased size.

Where the pregnancy has advanced to the fourth month or beyond, it is seldom easy to separate the adhesions and reduce the uterus until after one has emptied it by abdominal operation. Induction of artificial abortion often cannot be accomplished because the cervix and os are so far upward and forward that they cannot well be reached. The abdominal route is generally safer. One should not wait for bladder symptoms but should operate as soon as he has made the diagnosis and has found that he cannot easily reduce the displacement under anæsthesia. When the bladder symptoms appear, the case is usually in a dangerous stage. The dangers of shock are great and so is that of infection, which may already be present in the injured bladder.

Among the traumatic accidents of the uterus during pregnancy the most acutely serious is rupture of the organ. Premonitory indications of this calamity are practically nil. When we know of some scar in the uterine wall such as might have been caused by cæsarean section, extension of a cervical tear into the lower segment, former rupture, or other traumatism, we would bear in mind during the course of the pregnancy the

possibility of a rupture. Many cases, however, are not due to such scars but to a thinning of the uterine wall at the placental site of a former pregnancy. It often happens that the placental site is practically the same in different pregnancies. Therefore the cause of the thinning of the wall at that place will be increasingly active with repetition.

This cause of thinning in some cases is excessive cicatrization of the placental site because of infection there and consequent formation of granulation tissue. In cases where curettage has been performed postpartum or post-abortum for retained secundines, especially with the sharp instrument, the uterine wall at the locality of the placenta will have been traumatized, and scar formation replacing the mucous membrane and muscular tissue will have occurred.

Probably a more common cause of the thinning of the uterine wall at the placental site is excessive trophoblastic action of the cells and syncytium of the villi or even migration of chorionic elements into the musculature. When the wall has been thinned from some of these causes, at a previous pregnancy, it is of course more susceptible to injury from the action of trophoblasts in a subsequent pregnancy. On the other hand, it is not unprecedented for rupture at the placental site to occur in a primipara. In the absence of accidental wound, it is probable that most of these ruptures are the results of trophoblastic corrosion, analogous to such results in rupture of a pregnant tube.

Rupture of the uterus during pregnancy may occur even in the early months, but is less rare the nearer the pregnancy approaches full term. The main and first diagnostic points are sudden shock with symptoms of internal hæmorrhage. In the early months the diagnosis can hardly be differentiated from rupture of an ectopic gestation sac. At later periods the symptoms may point more closely toward the uterus as the seat of the catastrophe. Palpation or bimanual examination may reveal that the uterus is smaller than the period of gestation would warrant, that it is hard and contracted rather than soft, and that the fœtus can be felt outside the uterus. As a general rule the picture is that of a severe abdominal crisis suddenly appearing in a pregnant woman. The only active treatment which is advisable, namely, laparotomy, will settle the diagnosis and justify itself.

Beyer reports a case of spontaneous rupture of the uterus pregnant at three to four months. The fundus was ruptured across with a tear anteriorly. The uterus was removed and the patient recovered. Manual removal of the placenta had been done eighteen months before. Sections of the wall near the tear showed marked thinness with much connective tissue and few muscular fibers.

The literature of the past three years is not rich in reports of cases of rupture of the uterus during pregnancy. Tuchelt reports a case similar to Beyer's and gives a résumé of the causes.

The treatment of rupture after opening the abdomen will depend upon the extent and location of the rupture, the amount of hæmorrhage, the chances of infection, and somewhat on the age of the patient. In some few instances it will be safe to clear out the uterus, removing the fœtus and secundines, to suture the uterine wall as in cæsarean section, and to remove some of the fluid and clots from the peritoneal cavity. This procedure is only permissible when the rent is clean-cut and readily accessible, when the hæmorrhage has not been to the extent of apparent exsanguination, when the chances of infection are minimum, and when the woman is still young. Otherwise the uterus should be removed by supravaginal amputation.

Acute salpingitis calls for operative treatment no more during pregnancy than under other circumstances. It is a rare complication because, usually bilateral, it would preclude pregnancy in most instances. Since the infection would almost always be obliged to travel via the endometrium, that membrane would usually be too much damaged to permit conception or imbedding of the ovum. If infection of a tube occurred a little before or at the same time with conception, it might be possible for acute salpingitis to coexist with pregnancy. Palliative treatment would be the indication as in the non-pregnant state. The infection would be almost always with

the gonococcus which would usually have become innocuous by the time of labor.

A tubal abscess or other pelvic collection of pus which points at the vault of the vagina, especially if probably due to other microbes than the gonococcus or to mixed infection, should be opened *per vaginam*, especially during the early months. It is best to drain such a source of infection before pressure of the enlarging uterus ruptures the abscess with consequent danger of peritonitis or other puerperal infection.

Pastel and Dujol report a case in point.

A woman of 32 in her third pregnancy at one month, after carrying a heavy weight, complained of severe pain in the lower abdomen which soon subsided. One week later she had colicky pains especially on the right side. Later increasing abdominal pains sent her to bed. Her abdomen was distended with gas and very tender. She had no temperature. The uterus was slightly enlarged, with closed os and a large soft mass occupied the cul-de-sac, extending 5 centimeters above the pubes. Upon a diagnosis of ruptured tubal pregnancy, laparotomy was done. The uterus, pregnant two months, was found in front of a large fluctuating mass in the pouch of Douglas. Five hundred cubic centimeters of foul bloody pus was evacuated. There were no changes in the appendix, cæcum, or sigmoid. Both tubes were enlarged, and the right one contained a small collection of pus. Because of fear of infection, hysterectomy was performed. The chief microbe in the pus was the colon bacillus.

More often than the above the mistake is the reverse. I must confess to opening the vaginal vault on a diagnosis of pelvic abscess on more than one occasion and finding an ectopic gestation sac with dead fœtus and infected contents. So far I have been spared the chagrin of opening into an actively pregnant tube by vaginal operation undertaken for pelvic abscess.

The most important relation of the pathological ovary to pregnancy is that of ovarian tumor complicating the condition. The best exposition of this subject in recent years is that of our President, Dr. Barrett, published in SURGERY, GYNECOLOGY AND OBSTETRICS, in January, 1913, after having been read before this society. Among the important conclusions of the author are: (1) Induced abortion is unjustifiable. (2) Early removal of the tumor as soon as possible after diagnosis is recommended. (3) Tapping or puncture of the cyst is rarely justifiable. (4) A tumor of the ovary should be removed even during the latter half of pregnancy.

I will venture to disagree with him only on the last point. After the fifth month the uterus is occupying so much of the abdomen and is obstructing the entrance to the pelvis so completely that removal of an ovarian tumor which lies in a situation which may interfere with easy passage of the child is very difficult and must be attended with great chances of injury to the uterus. If the tumor is in the abdominal cavity where it does not threaten to interfere with the passage of the child, it does not require removal. It should be remembered that there is an increasing danger of dilatation of the laparotomy scar and consequent hernia the younger this scar is at the time of labor.

The frequency of ovarian tumors in pregnancy is 1 to 3000. Sixty-eight per cent of all cases are of the cystadenoma variety; 23 per cent embryoma (dermoid); 2 per cent fibroma; and 5 per cent malignant tumors. When the ovarian tumor causes disturbance from its presence during pregnancy, the most common complication is torsion of the pedicle, which occurs in 80 per cent of such cases. A larger proportion of ovarian tumors, especially embryomata, rupture or suppurate during pregnancy than under other circumstances. In about one-third of the cases of complicating ovarian tumors more or less serious consequences ensue; in about one-fifth pregnancy is prematurely terminated.

Torsion of the pedicle in ovarian cysts is more common in the first half of pregnancy than later and is rather more common at that period than in the non-pregnant woman. Evidently the growth of the uterus while yet in the pelvis and lower abdomen favors the twist, and the large uterus of the second half of gestation so crowds the abdomen that there is no room for the tumor to turn.

The diagnosis of ovarian tumor with pregnancy before any disturbance has occurred is not made unless one makes a routine examination and finds both the enlarged uterus and the tumor of the ovary present together. An ovarian tumor can only be distinguished

from ectopic pregnancy before rupture or abortion, by the fact that the ectopic gestation sac will grow progressively with the growth of the ovum. In uterine pregnancy complicated with ovarian tumor the uterus will grow progressively and the tumor will remain stationary or increase more slowly.

Torsion of the pedicle, rupture of the cyst, or suppuration within it will show symptoms not unlike those in the non-pregnant condition. Less severe symptoms may call attention to the tumor and lead to its discovery on examination. These will usually be signs of pressure within the pelvis due to the crowding by the tumor of the uterus, and the consequent disturbance of the functions of the bladder and rectum, as well as reflex symptoms of nausea and vomiting.

Modern opinion agrees that ovarian tumors should be removed if discovered during a stage in the pregnancy when they can be removed without great damage to the pregnant uterus. If discovered only at the time of labor or near labor and they are so situated that they are not interfering with the mechanism, they should be allowed to remain and be removed after the puerperium. If so situated that they are imperiling the passage of the child and the pregnancy is so far advanced that a viable child may be expected, cæsarean section should be performed with immediate removal of the tumor.

A STUDY OF THE MENOPAUSE WITH SPECIAL REFERENCE TO ITS VASOMOTOR DISTURBANCES[1]

By CAREY CULBERTSON, M.D., F.A.C.S., Chicago

THE observations upon which this study is based are presented in the nature of a preliminary report. They have occupied somewhat less than two years of clinical experience, and for this reason include a relatively small number of cases. The phenomena of the climacteric may conventionally be described as follows:

The general symptoms may be absent, constant, or intermittent, coming on at the average age of forty-seven years, according to the statistics of Kisch and Norris. They consist in nervous disturbances, such as irritability of temper, despondency, forgetfulness, all of which are common, with rarely or never a homo- or suicidal tendency. These psychic phenomena are also expressed in sleeplessness, anxiety, mental unrest, and perversion of taste.

The vasomotor disturbances are reflected in fainting, vertigo, numbness, sweating, congestions, flushes of heat with corresponding sensations of chillness, headache, dizziness, cardiac palpitation, cold hands and feet, and a tendency of the arms and legs to "go to sleep" readily.

The disorders referred to the gastro-intestinal tract consist in some degree of nausea, with or without vomiting, flatulence and distention, weight and distress in the epigastrium, so-called "heart burn," and marked constipation. The appetite is apt to become variable and capricious. Tilt observed diarrhœa in 12 per cent of his cases, but Kisch found obstinate constipation much the more frequent, an experience, I am sure, common to most clinicians. Kisch considers this an expression of intestinal stasis.

Neuralgias, especially intercostal, are observed and rheumatic or gouty pains, "pseudo gout," in the extremities or back and sacrum, showing a tendency to arthritis deformans. In some cases these pains are accompanied by superficial tender areas, strongly suggesting peripheral neuritis.

In relation to skin diseases, we find pigmentations, warts, acne, urticaria, herpes, zoster, pruritis, kraurosis vulvæ, and various other lesions characteristic of functional senile changes.

In past years prolonged uterine hæmorrhages were regarded as entirely normal dur-

[1] Inaugural thesis presented before the Chicago Gynecological Society, June 23, 1916. (See discussion p. 755.)

ing the climacteric. More recently these have been attributed to various pathological conditions affecting the uterus, and so strong has become the propaganda aimed at cancer prophylaxis that the gynecologic dictum has gone out that every bleeding uterus at the menopause is potentially malignant.

The response to the sexual impulse is usually represented as decreased, though this is probably not the case until after the climacteric years have passed. During the menopause the sexual response remains active, if, indeed, it is not exaggerated.

The physical changes characterizing the climacterium are so well recognized that they require but brief recital at this time. The atrophy of the genital apparatus is the chief change, the uterus becoming small and hard, the vagina constricted, the ovaries shriveled and sclerotic. The breasts shrink and there is a tendency toward either a loss of subcutaneous fat or its increase. Since the ovary is the important factor in this entire functional process, it is of interest to consider certain of the theories relating to its atrophy and resultant functional cessation. Thus Norris regards the eventual failure of ovulation to be due, not to the loss of all the germinal follicles, but to the accumulation in the ovarian cortex of numerous, scar-like corpora albicantes. These bring about a decreased vascularity and thus further development of follicles is inhibited. As a result the granulosa cells are no longer formed, and no further hormone is produced. The atrophic changes and the subjective symptoms previously reviewed are secondary to the discontinued production of this active principle.

Norris elaborates this theory into an explanation as to why the multipara arrives at her menopause later than the nullipara. In the former there are periods of several months each, during her respective pregnancies, when ovulation ceases; hence fewer corpora albicantes are formed in her ovaries. In the nullipara, where such a body is created regularly every month, with no intermissions during the years of her ovarian activity, the scar-tissue formation becomes excessively abundant about two years earlier.

These sclerotic changes in the ovary apparently precede the atrophy of the uterus and other genital structures, but, the two conditions operating together, there occurs a cessation of the menstrual flow. This, while the chief feature of her climacteric to the woman herself, should be regarded as a mere physiologic incident. According to Tilt, the flow ceased by a gradual diminution in 26.84 per cent of his 637 patients; it ceased by irregular recurrence in 24.33 per cent, and by a sudden stop in 14.76 per cent. It was profuse and scanty alternately in 5.65 per cent. Terminal attacks of metrorrhagia occurred in 28.41 per cent of these cases. Of another series of 446 cases, metrorrhagia was present in 31.16 per cent. This is extremely interesting in view of the fact that of these 446 cases but 16 were complicated by such conditions as uterine prolapsus, fibromyoma, carcinoma, and ovarian tumors. Of 500 cases tabulated by Kisch, profuse hæmorrhage occurred at the close of the menstrual life in 286, or 57.2 per cent. Yet of these but 3 were complicated by carcinoma and 5 by fibromyoma. Uterine displacement was present 117 times, or 40.9 per cent of the cases which bled excessively and 79 cases were classified as "chronic metritis."

The duration of the menopause is represented as subject to considerable variation. Thus Tilt finds that 12.07 per cent of all cases last 6 months, 22.64 per cent continue one year, 18.62 per cent require two years, and 9.43 per cent three years. Norris is inclined to regard long periods of duration as pathologic rather than physiologic. He finds that the average time during which a woman otherwise normal should cease to menstruate is 11.46 months. From 10 to 12 months was sufficient for 68 per cent of his patients to cease flowing and but 5 per cent took longer than 16 months. He regards a climacteric menstruation that lasts over 12 months as suspicious and one going past 14 months demands that the patient be examined. The chief feature of the menopause, the neuroses, antedate the beginning of menstrual irregularity and continue for 6 to 18 months after its cessation, the barometer of health being the character of the actual bleeding.

By way of approaching a consideration of

the menopause as an expression of ovarian deficiency, it would be well first briefly to review our present knowledge concerning the physiology of the ovary.

It is fairly well established, and generally accepted by this time, that the ovary is possessed of an internal secretion, the chemistry of which has not been worked out. This secretion, evidently in the nature of a hormone, is thrown off with the follicle and its production is continued for a variable number of days after rupture of the follicle by the cells which go to make up the active portion of the corpus luteum. As Bucura has so admirably expressed it, the corpus luteum is the histologic continuation of the follicle which has discharged its ovum. Whether these cells are connective-tissue stroma cells or identical with the granulosa cells need not be taken up at this time, though the present balance of opinion seems to favor the theory that they and the membrana granulosa are one and the same, hence of embryonic epithelial origin. Neither need we discuss the possibility of a second internal secretion being produced in the ovary, as has been suggested by various investigators, McElroy among them. It is true that, in certain of the lower animals, cells have been demonstrated in the ovarian stroma which suggest the function of "interstitial glands," but it is more probable, as Bucura claims, that such structures are merely vascularized embryonic connective-tissue cells serving as storehouses for hormones. Such a theory is certainly attractive and may explain as well the so-called "myometrial gland," described by Bouin and Ancel.

But while a chemical explanation of this ovarian secretion is still wanting, its physiological action has been extensively studied. Thus it is recognized that through the influence of this hormone the uterine mucosa is actuated into a condition of œdema as a preparation for the reception of a fertilized ovum. If such an ovum does not embed, the mucosa is bled out, producing the phenomenon of menstruation. Earlier in life the ovary undoubtedly is necessary to, if not the only factor in, the development of the genital apparatus and of the secondary sex characteristics. In the lower animals the corpus luteum is essential to the integrity of pregnancy during the early weeks, though this appears not to be the case in woman.

Aside from its influence aimed directly at the genital apparatus, the ovarian hormone is an important factor in the general organic economy. Here it can no longer be studied alone but must be considered in connection with the other glands of internal secretion, and here the problem becomes even more complicated and obscure. This is due not only to our imperfect knowledge of the physiology of the other ductless glands, but to the fact that the ovary functionates in a manner somewhat different from any of the others. We have every reason to believe that the thyroid, the pituitary, and the adrenal glands, for instance, are employed in producing and giving off their secretions more or less constantly and, at that, throughout the entire period of life. With the ovary, on the other hand, the secretion is thrown out intermittently, rhythmically and regularly, to be sure, but only for a few days at a time, the intervening periods being spent, apparently, in the development of a new follicle with a fresh charge of active principle. Moreover, the ovary does not begin to produce this secretion until the fourteenth year of life, and then secretes indifferently well for a few years, during which time there is considerable interglandular discord. After approximately thirty years of relative stability, due to harmonious collaboration on the part of the various bodies comprising the ductless gland chain, the ovarian function ceases more or less gradually, but definitely.

In the male the sex gland, like the ovary, does not develop into efficiency until adolescence. But after that it apparently provides its internal secretion steadily and constantly, ceasing only with old age. Indeed here, in a very general way, may be found the explanation for the psychic and physical differences between the adult male and female, the former characterized by stability, the latter by instability. But far more to our point in this argument, the intermittent activity of the ovary explains certain differences between the normal and the premature menopause. It has long been recognized by clinicians that

disappearance of ovarian activity in early maturity is but rarely accompanied by marked psychic or somatic reaction; that while menopause symptoms result from castration or ovarian disease in the young adult, yet these are, in most cases, not as aggravated as when they appear normally during the fourth decade. Bandler observes that post-operative disturbances are at first mainly of vasomotor nature and accompanied by psychic unrest. He also states that many patients show few or no symptoms at all, showing that the same variations are seen after castration as are noted in the menopause occurring along normal lines. Gloevecke thinks that castration develops an artificial climacteric which in all points resembles the natural. Abel states that the menopause following oophorectomy is quicker and sharper than that at the normal age.

On the other hand, Walker, Pfister, and Altherthum consider the conventional idea regarding the severity of the premature climacteric as erroneous. Pfister regards the influence which the ovary exerts on the organism as much overrated and hence castration is correspondingly unobjectionable. Altherthum claims that the complete removal of the ovaries does not result in the injurious effects on the mental and physical condition of woman that have been generally accepted. Fehling explains that psychic changes are seldom noted, and then only in women formerly neurasthenic or hysterical. This last statement is supported in a measure by Gordon who reports the after-results of castration in 112 cases. He refers to 34 young women suffering from various manifestations of neurasthenia, hysteria, or psychasthenia. After complete oophorectomy the psychic phenomena became aggravated. Of the other cases the psychic manifestations belong to any of the varieties of psychoneuroses, yet in ensemble they do not constitute any well-established form of psychasthenia. Some of these cases were under observation for as long as ten years, and their subsequent histories did not show the eventual development of true psychoses. Gordon's argument strongly urges the preservation of all normal ovarian tissue possible.

Unfortunately, the clinicians just quoted have not tabulated the ages of their patients, but I am of the opinion that they are all correct according to the various points of view. Undoubtedly many women pass through premature menopause free from subjective symptoms, just as some do after the forty-fifth year. Between thirty-five and forty-five the reaction is manifest, but theoretically should be less in degree than at forty-seven. Walker's most severe artificial climacteria occurred in women of nervous types who were 30 to 38 years of age. During the preceding decade, from twenty-five to thirty-five years, the deviation is usually mild or moderate, unless the patient was previously psychic. Ovarian loss before twenty-five years of age is rarely followed by any but slight manifestations of menopause. In my service at the Cook County Hospital I have treated over 200 cases of general pelvic peritonitis. The majority of these occurred in women between the ages of fifteen and twenty-five years. In the cases requiring operation it has been my constant aim to preserve ovarian tissue whenever surgically possible. Nevertheless in 12 per cent of these young women I have found it necessary to extirpate the uterus and both appendages. Of those whom I have been able to follow up — about 40 per cent — not one revealed either psychic or somatic manifestations sufficient to induce her to continue treatment. The majority of them considered themselves entirely well in being relieved of pain and leucorrhœa or menorrhagia.

This gradual increase in menopause manifestation according to age must not be considered as evenly distributed as my attempted description would indicate. On the contrary, it is subject to considerable variation. It may be explained, however, on the theory of duration of association. That is to say, the longer the endocrine glands are associated in function with the gonad, the more marked will be the disarrangement when that gonad is withdrawn. Hence the menopause reaction should be most marked by mid-life and, in the woman who has never menstruated, there should be, as there is, no reaction at all.

It is impossible, however, to study one of

the ductless glands alone, apart from its association, and obtain any broad idea as to its importance in the general economy. For this reason it is necessary to review very briefly the other organs in this system. This may be done very satisfactorily by following Frank's admirable formulation of the established data.

1. The hypophysis. Its hyperfunction is represented by acromegaly and, before puberty, by gigantism. Its hypofunction produces adiposity in adults. The anterior lobe is essential to life. The secretion from the posterior lobe raises blood-pressure, increases contractions of the pregnant uterus, and is an intestinal depressant.

2. The thyroid. Its hyperfunction is expressed in Graves' disease, and its hypofunction in myxœdema. It is not absolutely essential to life and the therapeutic value of its extract is well known.

3. The parathyroids. Their hyperfunction is uncertain, but may be expressed in osteomalacia and eclampsia. Their hypofunction means tetany in pregnancy. They are probably essential to life.

4. The thymus. Its hyperfunction is doubtful, but probably produces *status thymicus* and *status thymicolymphaticus*. Its functional disappearance is normal at ten to fifteen years of age. The value of its extract is indefinite. It is not essential to the continuance of life. According to Matti it takes part in some forms of hyperthyroidism.

5. The adrenals. Their hyperfunction is seen in hypertrichosis; in precocious puberty in infancy. Hypofunction gives Addison's disease. They are essential to life and show marked aplasia in *status thymicolymphaticus*. Suprarenin is a stimulant to the uterus and a depressant to the intestine. Its action in temporarily producing arterial hypertension and in lessening the coagulation time of blood is well established.

6. The pancreas. Its hyperfunction is uncertain. Its hypofunction is represented in diabetes, and its extracts are thus far useless. It is essential to a continuance of life.

7. The pineal gland. Its hyperfunction is expressed in obesity or cachexia, its hypofunction in bodily and sexual precocity. It is not essential to the continuance of life.

8. The ovary. Its hyperfunction is seen in certain forms of menorrhagia and in premature sex development in infancy. Its hypofunction produces infantilism in childhood and amenorrhœa and obesity in the adult. It is not essential to life. Its influence in the elimination of sugar and calcium is obscure. The extract from the corpus luteum of early pregnancy has a recognized value, and, as I shall emphasize later, is a definite depressor in arterial hypertension.

If we accept this data as accurate, the obvious implication is that sound bodily development and functional integrity depend on close co-operation on the part of these ductless glands. In their various capacities they tend to interact differently at different times. Thus at one time certain ones may neutralize or check each other, at another time the same glands work as complements. An attempt to formulate any such interrelation tends rather to obscure the situation than to clarify it. Thus Redlich regards the ovary as inhibiting the thyroid, while the hypophysis and adrenals excite the parathyroids. To others the antagonism between the thyroid and ovary is not obvious, but they seem rather to act complementarily. My own results lead me to accept this latter opinion.

According to Caro, the parathyroids, the thymus, and the pancreas inhibit the thyroid and the adrenals, while the thymus stimulates the hypophysis. The ovary stimulates the uterus and neutralizes the hypophysis and the adrenals. The mammary gland, in turn, inhibits the ovary. In pregnancy, a new hormone, thought by Halban and Hermann, and later by Frank, to be identical in its physiological action with that of the corpus luteum, is derived from the early trophoblast, through which the balance of health is maintained.

It is evident, then, that the withdrawal of one or more of these secretions from the economy will be followed by glandular discord, and this is exactly what happens at the climacteric. The time has come, therefore, when the menopause must be regarded as a functional disarrangement on the part of the endocrine glands, the ovarian secretion having ceased. With the acceptance of this view, we are able to explain its signs and symptoms with considerable satisfaction. At once we see that the very varied series of pictures expressed by patients passing through this period in life are extremely suggestive of various functional disorders, symptoms-complex, and syndromes long familiar to the physician. Thus many cases present pictures resembling hyperthyroidism, a few suggest myxœdema. In others we see a tendency toward acromegaly, to dystrophia adiposogenitalis, or oppositely, to a subcutaneous

wasting resembling cachexia. It is true that the somatic evidences of the menopause are better explained on this basis than are the psychic. But, aside from the fact that it is not always easy to differentiate nervous or mental expressions from the physical, yet, as I have previously brought out, Gordon shows that true psychoses are virtually never produced *de novo* during the menopause. Barnes more recently has emphasized this same point, going so far as to state that with the exception of puerperal toxæmia there is no toxic or endocrinic disorder referable to the female generative tract to act as a cause in the production of any psychosis. This directly controverts Bossi in his well-known views.

The climacteric then is a monoglandular affair only in its etiology. In its manifestations it is polyglandular. Apparently leaving out of consideration the influences of the hypophysis and adrenals, Bandler regards the menopause as a relative hyperthyroidism in most instances, and hypothyroidism in the remaining few. The excitable type he attributes to excessive secretion, the depressed type to deficiency. He attributes even the gastro-intestinal derangements to thyroid irregularity and claims to have produced flushes and other vasomotor disturbances by feeding thyroid extract in excess to patients showing ovarian deficiency. This can be done, as I shall show, but should be attributed rather to oversecretion from the pituitary and adrenal glands produced by the thyroid stimulation in the absence of the ovarian check.

As the ovary decreases in its efficiency, the thyroid may maintain its full power; more often it declines, in some degree; occasionally it becomes definitely deficient also. In the first instance, a positive hyperthyroidism would result, in the second, a relative hyperthyroidism, in the third, hypothyroidism. But in any one of these three phases, the hypophysis and the adrenals would show more or less characteristic dysfunction. Thus the pictures would be modified variously. It may be, too, that the pineal, or the parathyroids may enter into the situation on occasion. Again, in the usual case the withdrawal of the ovary is gradual or intermittent; hence its influence is present at times, and at times absent. We see, then, that the menopause may present as many different aspects as there may be single glands, or combinations of glands, working together in harmony under the influence of the ovarian hormone, or out of harmony during its absence.

The question of possible change in the character of glandular secretion comes in properly at this time. Bensley has shown that in certain goiter conditions, such a change takes place. Were this true at the menopause, the entire argument would be tremendously influenced. It may be, indeed, that certain of the hormones are modified in some degree, suggested by those patients who do not yield so readily to treatment. But for the most part, as Falta has explained, there is no evidence to substantiate such a suggestion in the absence of actual glandular disease or organic change, the probability being that the menopause represents, as has been stated, a purely functional disarrangement of otherwise normal organs.

The influence of pituitary extract and of suprarenin in maintaining, or in elevating arterial tension is widely recognized. That this influence has not been applied in explanation of menopause derangement is surprising. In a search of the literature covering this point, I find but one reference. Schickele, in discussing the vasomotor symptoms of the artificial and normal menopause, points out that sweating, flushes, and dizziness are accompanied by arterial hypertension. That this is true there can be no doubt. All of my cases, with four exceptions, showed a definite and positive elevation of blood-pressure.

Of the vasomotor disturbances, sweating and sensations of heat are best known to the patient. In the light of my experimental work, the relation between these symptoms and hypertension is very close. The flush, of course, is a superficial erythema produced by a momentary dilatation of the arterioles and capillaries. This, in turn, leads to profuse perspiration and the sensation of chilliness after the vessels have again contracted. Arterial tension being elevated, the flush is accompanied by a sudden drop in pressure, both systolic and diastolic, with as speedy a

return, as if the pressor substance had lost its grip for the moment, or as if something had produced an evanescent vasomotor inhibition or paralysis. Frank questions the functional factor of this pressure elevation, demanding more proof that it is not the physiological sequel of advancing age or premature senility. Aside from the fact that it is too constant a finding in women too young for sclerotic arterial changes, to my mind the flush itself is proof that the menopause hypertension is a purely functional affair. No such phenomenon is apparent in the true arteriosclerosis of old age or in the blood-pressure rise that accompanies, for instance, interstitial nephritis or gestation toxæmia. In these latter conditions we have a constant and consistent elevation, yielding slowly, or not at all, to the strongest therapeutic efforts. On the contrary, the climacteric hypertension may be likened to the flickering northern lights, constantly going up and down, unstable, and yet always above the horizon in some degree. Somewhat further on I shall show other differences between this type of increased blood-pressure and that of sclerosis.

Early in my observations I attributed the hot flush to the influence of the adrenals, having in mind their well-recognized faculty for giving rise to such emotions as fright, anger, anxiety, etc. In some cases I have been able to produce the hot flush by injection of suprarenin, with a rather characteristic blood-pressure rise and fall. In other cases the same thing has been accomplished by pituitrin. In no one case, however, has the flush been created by both suprarenin and pituitrin given at different times; that is, where one agent would produce the flush the other would not and where the flush was not aroused, arterial pressure was not materially changed.

The question of intestinal stasis is also closely allied to hyperfunction of both the hypophysis and the adrenals. In his experiments on animals, Hoskins has shown that where suprarenin or pituitrin is given in doses sufficient to raise arterial pressure, a positive intestinal paralysis ensues. In five cases out of six pituitrin produced a clean-cut depression of tonus and peristalsis when injected intravenously into the small intestine, the dorsal portion of the cord having been destroyed. The effect of epinephrin on any organ is shown to depend on whether that organ has a sympathetic innervation. If so, the effect is stimulative or depressive, depending on the function normally mediated by the organ's sympathetic fibres. Hence the uterus is stimulated and the intestines are depressed.

Here again we see a two-fold explanation of the gastro-intestinal disturbances of the menopause. In every case where either pituitrin or adrenalin excited hypertension and hot flushes, the pre-existing constipation seemed to become more obstinate. In none of these cases could I demonstrate gastric or intestinal ulcer, pyloric stenosis, gastric ptosis, or even hyperchlorhydria. Indeed, so closely allied in certain physiologic aspects are the hypophyseal and adrenal hormones that Watanabe and Crawford have endeavored to ascertain if suprarenin may not be present also in the pituitary.

With ordinary doses of thyroid extract, nervous symptoms have been increased. With excessive doses, the nervousness has become marked, and cardiac palpitation and sometimes tremor has been produced. Some patients have shown an increase in hot flushes and arterial tension has become more unstable, but in no instance have these manifestations been so clearly cut as when produced by injections of suprarenin or pituitrin. On the other hand, certain patients have shown no response to as much as thirty grains of thyroid extract daily, but have been rather benefited by its administration.

For the purpose of this study I have eliminated from consideration all cases in which there were present any organic factors tending to produce arterial hypertension. Thus patients showing albumin or casts, or valvular heart lesions, or myocardial degenerations, or syphilis are disregarded, except for the sake of contrast. In a study of high blood-pressure during the menopause, uterine hæmorrhage becomes an inevitable complication. Hence all factors leading to menorrhagia or metrorrhagia have also been eliminated. Thus I have left out of discussion all neoplasms of the pelvis, all uterine wall and mucous membrane

conditions except those due to pregnancy, and all inflammations. Since the great majority of patients come to us with more or less genuine pathology, such extensive elimination has left a surprisingly small number of cases as the material upon which this study is based. As it is, I shall forego all discussion from the point of view of uterine hæmorrhage until a future opportunity.

To return to the question of blood-pressure, I have thus far referred to its functional change during the menopause as a mere hypertension. This now requires more specific exposition. As stated, arterial tension is elevated and is unstable, rising and falling under relatively minor influences. Its peculiarity lies in this observation, that, in rising, the diastolic pressure does not go so high proportionately as does the systolic. This gives a characteristically irregular and universally increased pulse-pressure. This disproportion is observed even in the four cases without hypertension. Thus the chief characteristic stamping the vasomotor disturbance of the climacteric seems to be a disarrangement of the systolic-diastolic relation producing elevation in the pulse-pressure. In blood-pressure estimations, then, we find a fairly reliable measure of the vasomotor disturbances of the menopause and, as will be shown, a satisfactory method of controlling treatment.

If we accept the propositions thus far laid down, that the cessation of ovarian activity leads to a functional overefficiency on the part of the pituitary and adrenal glands, and that this, in turn, produces an arterial hypertension, the corollary is that, by the administration of corpus luteum extract, the pressor substances will be neutralized and the tension will decrease. This ability on the part of the corpus luteum to decrease blood-pressure has been recognized for some years. Schickele called attention to it in 1913 and more recently Dannreuther laid emphasis on it in discussing the treatment of various pelvic disorders, and especially in the premature or induced climacteric. Dannreuther also called attention to the importance of watching the blood-pressure while administering corpus luteum to women suffering from dysmenorrhœa, sterility, premature menopause, etc. He advised that the pressure be allowed to fall not more than ten or fifteen points at a time. Thus the earlier observations of McIlroy, Krusen, and others, that the corpus luteum secretion is physiologically similar to that of adrenalin and raises the blood-pressure have not been substantiated. In testing it for epinephrin, Fenger found that the corpus luteum both of menstruation and pregnancy responded negatively. In my cases I found that when arterial hypertension had been overcome it was a rather easy matter to hold the pressure near the normal line by a proportionate reduction of the dose. In younger women, with little or no hypertension, or even with hypotension, there is frequently a corresponding thyroid deficiency. Where thyroid extract can be given together with corpus luteum, arterial tension can be kept from falling too low.

When the corpus luteum first came into therapeutic use, the results obtained were very variable, and too often unsatisfactory. According to Hare, Champy and Gley were the first to show that the corpus luteum from pregnant cows was exceedingly active, whereas that from non-pregnant animals possessed little physiological action. Hare's, Burnham's, and later Dannreuther's reports established the practical value of this experimental work when applied clinically. Meantime, many others have contributed reports on this therapy. Wherein the difference lies between pregnancy and menstruation corpora lutea has been explained by Fenger and Corner. In a recent publication issued by the Carnegie Institute, Corner shows that interesting histological changes take place in the lutein cell during gestation, characteristics never seen in the lutein cells of menstruation. He likens the yellow body of pregnancy to an army, that of ovulation to a mob, the former being much more regular, stable and active. In my own work I have employed the extract from the true corpus luteum exclusively. Not only does the blood-pressure show a consistent and gradual decrease, but the diastolic and systolic pressures tend to come into normal relation. Where the pressure has been rather high and the vasomotor symp-

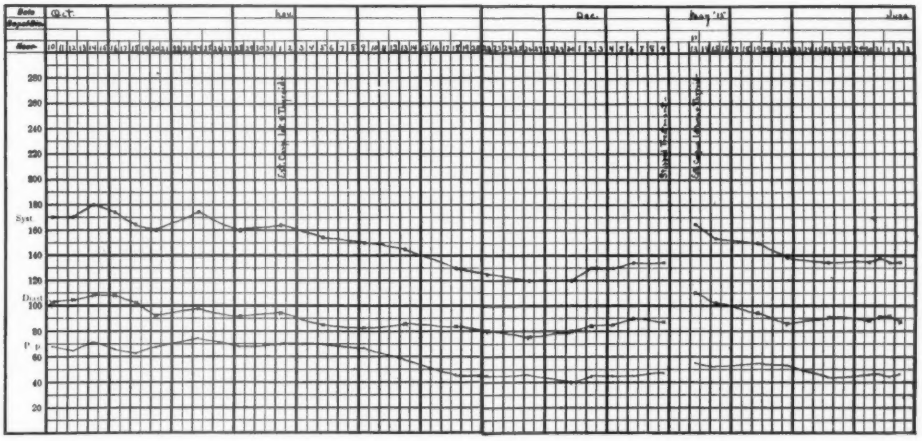

Chart 1. Case 1, Mrs. M. E. G.

toms marked, this fall may be accompanied by what seem to be aggravated symptoms; that is, hot flushes are more frequent, sweating more profuse, and sometimes headache or dizziness is more marked. As the arterial tension approaches normal, however, these symptoms decrease, and the general condition becomes very much improved. As a general proposition, results have been extremely satisfactory. Where metrorrhagia was present, it has ceased with the reduction of arterial tension in all cases where the uterus was normal. A fuller discussion of this phase of the subject, I hope to take up in the future. Results with respect to nervous and mental symptoms have not been so brilliant as I was led to anticipate from Hare's report. This may be due to the fact that, in order to prove my point in regard to the vasomotor disturbance, no cases have been managed according to conventional treatment for arteriosclerosis or hyperthyroidism. Rest in bed, diet, and any other medication has been avoided. On the contrary, I have insisted that the patients live as nearly a normal, active life as before undergoing treatment. No doubt, in these cases characterized especially by nervous manifestations, conditions would be further improved if treated as in hyperthyroidism.

The following brief case reports, with attached charts, will best bring out the points illustrating my argument:

CASE 1. Chart 1. Mrs. M. E. G., age 40. Never pregnant. Slender, and somewhat undernourished. Nervous and emotional. Marked constipation and some gastric distress. Metrorrhagia for several weeks. Blood-pressure unstable, systolic varying between 160 and 180, diastolic from 100 to 110. Under corpus luteum and thyroid extracts tension became normal and metrorrhagia ceased. Vagina constricted and uterus small and hard, appendages negative. Patient went South for the winter and stopped treatment. Five months later blood-pressure was again raised, 165, and she was again nervous and constipated. Tension came down very promptly upon repeating thyroid and corpus luteum. Operation showed the uterus to be small and hard with atrophic mucous membrane and no changes in the walls. The tubes were normal and the ovaries atrophic, the right one fibrocystic. Treatment irregular for one year. Nervous and digestive symptoms were much improved. She had gained 20 pounds in weight. Moderate hot flushes returned when she discontinued treatment one month and blood-pressure rose to 170, systolic.

CASE 2. Chart 2. Mrs. F. B., age 40. One child. Robust and well-nourished. Weight, 160 pounds. Had been refused insurance because of high-blood pressure. An active worker in a social settlement. Somewhat nervous and had had hot flushes and sweating for six months. Menstruation began to be scanty in April, 1914, and was missed in September. On September 30 systolic tension was 180, diastolic 110. She was given both corpus luteum and thyroid extracts and blood-pressure was normal by the time she returned from a vacation in November. Menstruation returned in October and

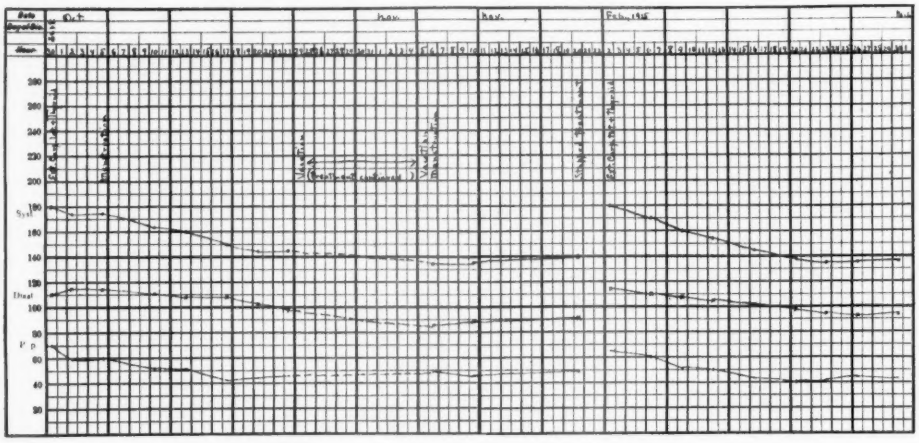

Chart 2. Case 2, Mrs. F. B.

was regular in November and December. Pelvic organs apparently normal. Treatment was stopped in December and she missed in January. On February 2, systolic tension was again 180, diastolic 115. This was again reduced to normal in three weeks.

Case 3. Chart 3. C. C. H., 579,335, age 47. Four pregnancies. Undernourished and asthenic. Menstruation had not ceased, but a more or less constant metrorrhagia for two months. She complained of hot flushes and chilly sensations, headaches, sweating, marked constipation, and extreme nervousness. Pelvic examination was negative except for a somewhat enlarged hard uterus. Leucocytosis 10,000, hæmaglobin 85 per cent. Blood-pressure varied from 160 to 200 systolic, with a relatively normal diastolic tension. It was reduced to normal in one week with extract of corpus luteum. Metrorrhagia then ceased but the leucocytosis persisted. Subsequent hysterectomy revealed a uterus with thickened fibrotic walls. The mucosa was atrophic and in the fundus was a subserous fibroid 1½ centimeters in diameter, the center of which showed red degeneration.

Seven months later this patient was again under observation for four weeks. She had nearly completed a speedy and mild menopause. Hot flushes were mild and infrequent, headaches and constipation absent, nervousness much improved. Systolic tension showed a daily variation of only five points, 145 to 150, diastolic 120 to 125.

Case 4. Chart 4. Mrs. J. G., age 52. Four pregnancies. Slender but fairly well-nourished. Thyroid gland somewhat prominent, with nervousness and tremor. Had been under treatment several years ago for hyperthyroidism. She had never ceased menstruation. One year before she sustained uterine hæmorrhage and menstruation had been regular and excessive ever since except for a six-weeks' period of amenorrhœa. She had noticed hot flushes for one year. Her blood-pressure varied from 160 to 190 systolic, diastolic being subnormal. The systolic came down in one week with corpus luteum extract, accompanied by an absolute cessation of uterine hæmorrhage. Diastolic tension dropped at first but later approached normal. In this case there is undoubtedly a degree of absolute hyperthyroidism, giving an exaggerated aspect to the menopause picture. Vaginal hysterectomy showed a characteristically multiparous uterus, only moderately fibrotic, mucosa atrophic. Both ovaries were markedly shriveled.

Case 5. Chart 5. Mrs. E., age 44. One child. Somewhat undernourished. Small thyroid. Very nervous and excitable, weak and fatigued, difficult. Has always been so but worse during past year, during which time she has had hot flushes at times, headaches and cold extremities. Recently she had a uterine hæmorrhage and was terrified by suggestion of cancer. Blood-pressure varied from 148 to 180 systolic, diastolic 50 to 100. Under corpus luteum this became subnormal but has not been easy to control. The vasomotor symptoms have been relieved, the psychic not so well.

Vaginal hysterectomy showed a uterus only slightly enlarged and fibrotic with a normal mucous membrane. Both ovaries were atrophic.

Case 6. Chart 6. Mrs. H. G., age 49. Five children. Very large, overnourished, obese. Amenorrhœa for two years. Hot flushes and nervousness with cardiac palpitation is less marked now than formerly. Now severe constant headache and pressure and pain in the back, obstipation and bearing down. Pain in the right leg and shoulder and behind the ear. April 14, blood-pressure: systolic 250, diastolic 90. She was put to bed and given

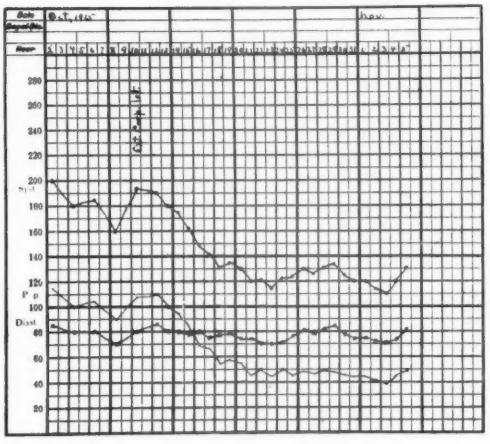

Chart 3. Case 3, C. C. H., No. 579,335.

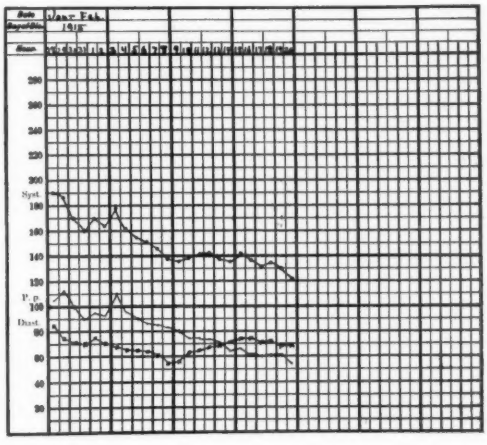

Chart 4. Case 4, Mrs. J. G.

aspirin. Ten days later arterial tension: systolic 230, diastolic 100. On this date she was "tested" with adrenalin. The systolic pressure rose from 205 to 225 and then began to drop, reaching 195 before again going up. During this descent she experienced numerous hot flushes and profuse sweating. On April 25 the extract of corpus luteum was started and during the succeeding days, while pressure was decreasing, she again experienced many flushes and marked perspiration, as well as some gastric disturbance — nausea. The pulse pressure in this case was exceedingly high and the difficulty in pressure reduction would indicate the strong probability of true arteriosclerosis or myocardial change being present.

Case 7. Chart 7. C. C. H., 577,926, age 50. Eight children. Overnourished. Has not ceased menstruation, and metrorrhagia during past three months. She has experienced headaches, hot flushes, perspiration, gradually increasing nervousness and palpitation of the heart, with obstipation. Blood-pressure varied from 160 to 180 systolic, diastolic 100 to 110. With corpus luteum extract this came down to normal in ten days; metrorrhagia disappeared but the next period was profuse. Vaginal hysterectomy was then performed. In the uterus the changes of multiparity were present, numerous large blood-vessels and an increase of fibrous connective tissue in the walls. The mucosa was atrophic and thin except for a pin-head-sized polyp in the cervix. Both ovaries were small and atrophic.

Case 8. Chart 8. C. C. H., 574,876, age 45. Four children. Thin, asthenic, undernourished, very senile in appearance. Amenorrhœa at 43 for 1 year; then flowed every two or three months excessively, mildly but constantly the past three months. Nervous and marked hot flushes. Obstipation. Blood-pressure, systolic 170 to 190, diastolic 105 to 120. This patient was tested with adrenalin without increasing the menopause symptoms. Pituitrin resulted positively, increasing the hot flushes and sweating and the metrorrhagia. With corpus luteum extract the tension came down in 10 days, sweating and flushes being marked during the descent, lessened eventually. Metrorrhagia also ceased with normal blood-pressure.

Both ovaries were shrunken and cystic. The uterine wall was thickened to twice its normal size; the mucosa was hyperplastic.

Case 9. Chart 9. C. C. H., 564,114, age 42. Three children. Recent increase in weight. One and one-half years ago missed three periods; 6 months ago missed four periods. Bleeding irregularly during past 2 months. Hot flushes at times for two years; nervous and irritable. Curettage for diagnosis negative, the uterus being 3 inches deep, hard, upright; mucous membrane firm and thin. Systolic pressure, 165 to 180, diastolic 95 to 115. Under corpus luteum medication tension decreased to normal in twelve days, with amelioration of symptoms and complete cessation of metrorrhagia.

Case 10. Chart 10. C. C. H., 594,600, age 36. Two pregnancies. This patient, a negress, represents one of the few who showed a relatively low and stable arterial tension. Menstruation began at 12 years. Following her second labor at 17 years of age she was sick with fever and pelvic pain for three months. Since then her periods have been regular but very scanty, amounting merely to a pale red-stained mucus. At 26 she was operated upon *per vaginam* without change in the character of her periods but her weight has increased to 170 pounds. She has had hot flushes, cold extremities and marked psychic manifestations since her twenty-seventh

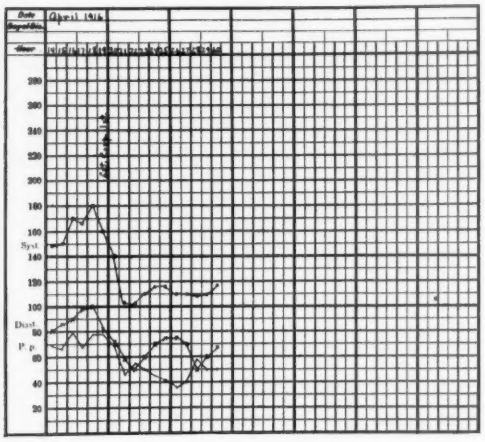

Chart 5. Case 5, Mrs. E.

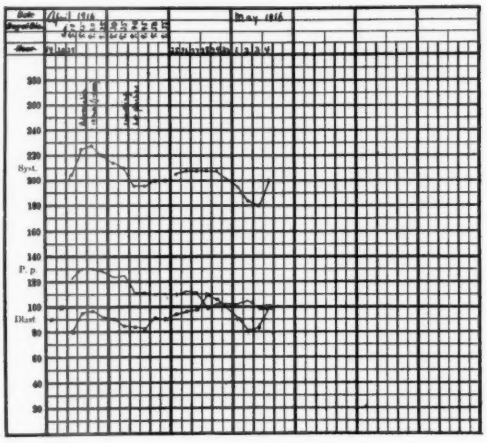

Chart 6. Case 6, Mrs. H. G.

year. Examination reveals a narrow, constricted vagina; atrophic cervix; small, hard, firm uterus; small appendages. Thyroid shows no enlargement.

This patient was tested with both adrenalin and pituitrin for the purpose of producing menopause symptoms. Adrenalin gave negative results, lowering arterial tension and increasing respiration, the patient's only sensation being one of tightness in the thorax with more rapid breathing.

With pituitrin, however, she reacted promptly and definitely as chart shows. Both systolic and diastolic tensions were disturbed, at first by elevation, then by drop, with pulse pressure constantly high. Numerous hot flushes and profuse sweating accompanied this disturbed tension.

Large doses of thyroid, as much as 30 to 60 grains daily, far from producing disturbance, resulted in improvement. She was subsequently given both thyroid and corpus luteum extracts.

Case 11. Chart 11. C. C. H., 580,906, age 33. Three children. Complains of constipation, backache, headache, dizzy, tinnitus aurium. Onset gradual for two years. Hot flushes, chilly sensations for 18 months; moderately nervous. Menses regular previously, irregular for 18 months, occurring every six to eight weeks, increased in amount. Systolic pressure varied from 150 to 165, diastolic, 90 to 100. Reduction to normal took place in one week with corpus luteum extract. Upon operation, the uterus was found to be enlarged and hard, the

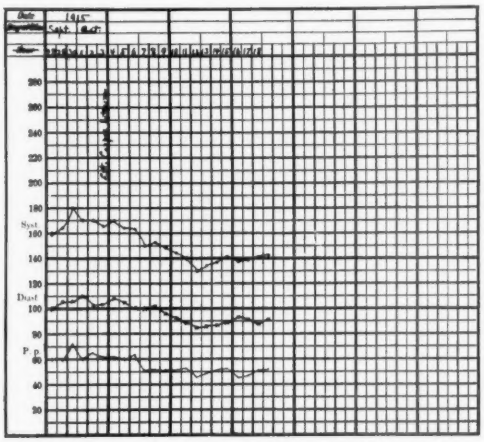

Chart 7. Case 7, C. C. H., 577,926.

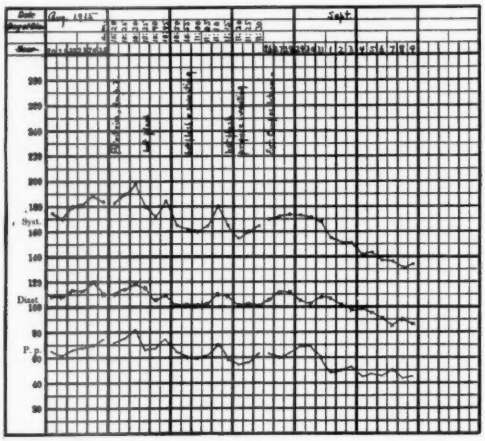

Chart 8. Case 8, C. C. H., 574,876.

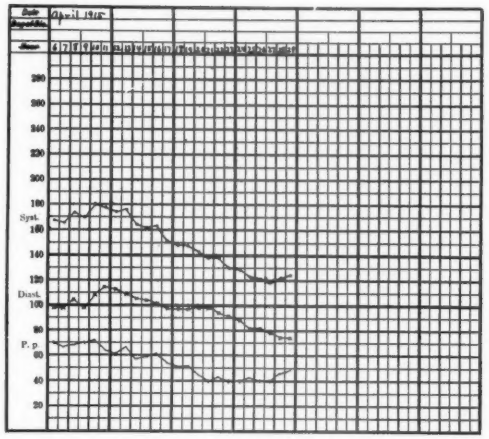

Chart 9. Case 9, C. C. H., 564,114.

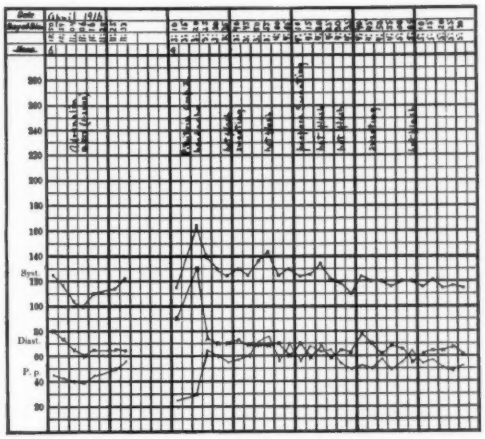

Chart 10. Case 10, C. C. H., 594,600.

walls thickened by an increase of connective tissue, blood-vessels increased in number and size, mucosa diffusely hyperplastic. The left ovary was represented by a cyst the size of a hen's egg; the right ovary was the size of a lima bean and cystic.

CASE 12. Chart 12. C. C. H., 558,457, age 37. One child, 5 abortions, the last 6½ years ago. Well-nourished. Seven years ago had an operation for tubal pregnancy. Menses had been regular until 2 years ago, since which time she has been nervous and emotional, sleeps poorly, has hot flushes, perspiration, cardiac palpitation, and severe headaches, especially when bleeding. Has had vaginal hæmorrhage every two to three weeks, lasting a few days to six weeks at a time. Systolic tension was 180 to 200, diastolic 95 to 110. With corpus luteum and thyroid extracts it came down in 2 weeks to normal and the metrorrhagia ceased. The uterus was small and very hard, but its wall was thickened and showed a moderate fibrosis. The blood-vessels were prominent and the mucous membrane thin. The right tube and ovary were absent, the left ovary was small and cystic. Both the mental and vasomotor symptoms largely disappeared during the continuation of the treatment.

CASE 13. Chart 13. C. C. H., 573,047, age 34. Four pregnancies. Robust, becoming obese during past two years. Wakeful at night, nervous and irritable, headache, backache, easily fatigued, hot flushes and chilly sensations, all increasing during

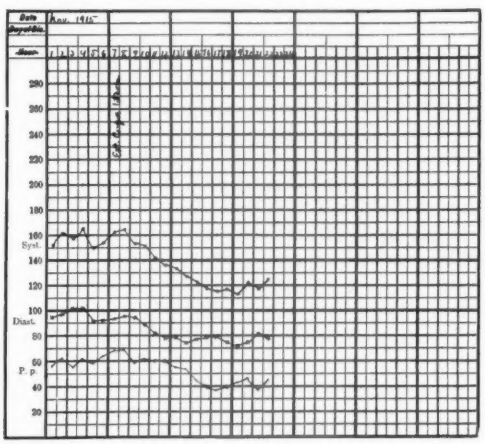

Chart 11. Case 11, C. C. H., 580,906.

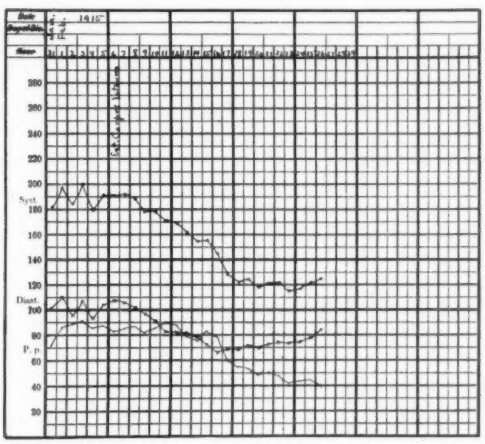

Chart 12. Case 12, C. C. H., 558,457.

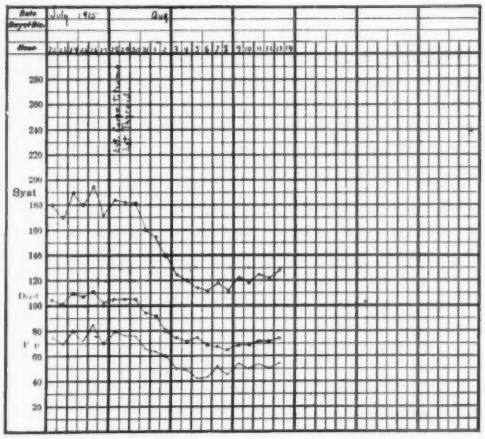

Chart 13. Case 13, C. C. H., 573,047.

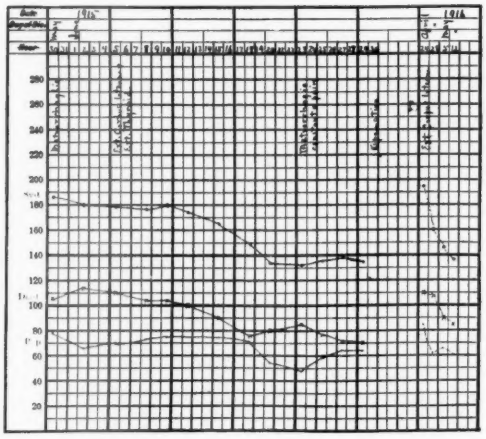

Chart 14. Case 14, Mrs. E. D.

the past two years. Menses regular until one year ago, since then markedly decreased in duration and amount, often pale and scanty. The uterus was two inches deep, small, firm, and free; appendages not palpable. Blood-pressure was 170 to 195 systolic, 100 to 110 diastolic. It decreased readily under corpus luteum with an almost complete disappearance of the symptoms.

Case 14. Chart 14. Mrs. E. D., age 39. No children. Weighs 180 pounds. Fifteen years ago had an ovarian abscess; treated by vaginal drainage. Has noticed hot flushes and chilliness for three years. Menstruation regular but less in amount since operation fifteen years ago until November, 1914. Metrorrhagia then began with dysmenorrhœa. Blood-pressure March 30, 1915: systolic 185, diastolic 107. Under corpus luteum and thyroid extracts it fell to normal in three weeks but metrorrhagia and pain continued, though diminished. The uterus was enlarged and hard but symmetrical and free. It was removed by vaginal hysterectomy and showed two small interstitial fibroids in its fundus. There was no left ovary and the right was markedly cystic and was removed with the uterus and tubes.

This patient again came under observation March 4, 1916. Systolic tension 195, diastolic 110. By May 12 tension was reduced to 138–75, by fifteen grains of corpus luteum extract daily. Ten grains daily serves to hold the tension between 130 and 140.

Case 15. Chart 15. C. C. H., 553,943, age 40½. One child. Complains of menorrhagia and metrorrhagia, with menopause symptoms, hot flushes, headache, obstipation, and nervousness, especially during the periods of bleeding. During the past month she had noticed blood-stained expectoration. The urine showed albumin and a few granular casts. December 1, 1914, her systolic pressure was 190, diastolic 100; reduced to 118–82 by December 26 with extract of corpus luteum. By this time the metrorrhagia and blood spitting had ceased, casts had disappeared but slight albuminuria persisted. Vaginal hysterectomy was then performed. The uterus showed marked fibrosis; the left ovary was a lemon-sized cyst, the right atrophic and shriveled. Sputum was negative for tubercle bacilli, the lungs showing chronic bronchitis. In this case the nephritis cannot be ruled out as an element in the hypertension nor the fibrosis uteri as a factor in the metrorrhagia.

Case 16. Chart 16. C. C. H., 582,914, age 47. No children. Had gained considerably in weight during past three years but complained of hot flushes and chilliness, weakness, fatigue on effort, sleeps poorly, very nervous. She had had a previous operation, evidently a hysterectomy, not having menstruated since. The thyroid was very small. The vagina was constricted, no other pelvic organs being palpable. Reflexes were absent or decreased except those of the biceps, triceps, and extensors of the arms. The Wassermann test of the spinal fluid was positive. Systolic tension was 172, diastolic 110, reduced in three weeks to normal by corpus luteum extract. The dose was not decreased promptly enough, which accounts for the subnormal pressure during the fourth week. In this case, of course, the luetic element may have been a factor in a genuine arteriosclerosis.

Case 17. C. F. D., age 48. Five children and several abortions. A small, undernourished woman. Thyroid palpable. Amenorrhœa for one year, hot flushes, weakness, and fatigue on effort. No dizziness but some headache and palpitation of the heart. The uterus was firm and small, retroverted and prolapsed, with rectocele and cystocele; ovaries not palpable.

Systolic pressure was 164 and 170, two readings,

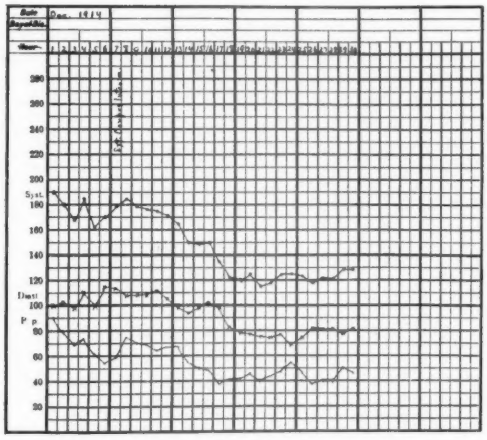

Chart 15. Case 15, C. C. H., 553,943.

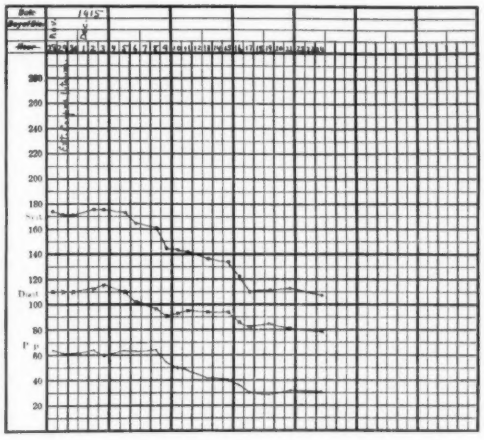

Chart 16. Case 16, C. C. H., 582,914.

diastolic 96 and 100. This patient did not return for the treatment advised.

CASE 18. Mrs. A. K., age 42. Two children. Well-nourished and developed. Was operated upon four years ago for cervical fibroid, at which time the right ovary was removed, the left resected. She is now nervous and emotional, has hot flushes, cold hands and feet, obstipation. She has always been capricious and whimsical but these characteristics have become more pronounced. She is now dissatisfied and restless. Thyroid small. Blood-pressure varies from 155 to 170, systolic; 95 to 110, diastolic. This patient is still under observation.

CASE 19. Mrs. L. H. W., age 37. Two children. Well-nourished and increasing in weight. Menstruation every 4 to 8 weeks, lasting 3 to 7 days. Left ovary removed 7 years ago. Recently menses have come every 25 days and more profusely. She had always been neurotic in type and complained of increasing depression, "nerves giving out," easily tired, unable to walk or work, restless, hot flushes, chilly sensations, perspiration, and palpitation of the heart. These symptoms had all been increasing during the past 5 months. Thyroid gland not increased in size. Blood-pressure systolic 170–172; diastolic 110–110, two readings. Under thyroid and corpus luteum extracts she reported herself as improved but "far from well." Her case was not followed up satisfactorily.

CASE 20. C. C. H., 592,888, age 36. One child. Has been growing very fat during past 4 or 5 years, with a diminution of menses. This, formerly normal, now appears irregularly, for 1 day at a time and is scanty, often very pale. No menorrhagia or metrorrhagia. No hot flushes or nervousness. Systolic tension 130 to 145; diastolic 100 to 105.

This patient was tested with pituitrin and showed no tension reaction whatever and no hot flushes. A few days later adrenalin was equally ineffective. Large doses of thyroid extract made her somewhat nervous and emotional but with moderate doses her condition improved.

CASE 21. C. C. H., 583,802, age 33. Three children. Well-nourished. Menses began at 19 years and never came oftener than every three to four months, scanty; at present, very scanty, pale and irregular. Psychic symptoms are absent but she experiences mild hot flushes and chilliness. Thyroid scarcely palpable and pelvic organs negative. Her blood-pressure is quite stable, systolic 135 to 140, diastolic 85 to 90. This case demonstrates the relative absence of menopause symptoms and increased blood-pressure where the ovaries have been deficient from the first.

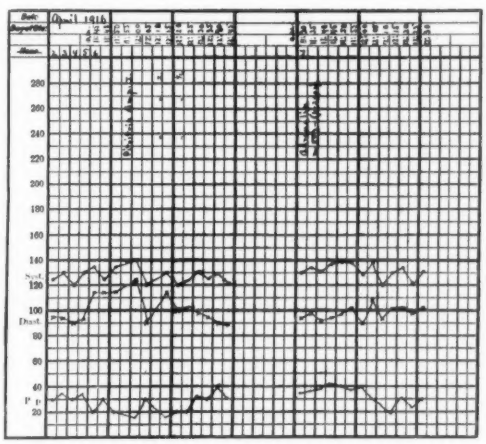

Chart 17. Case 29, C. C. H., 594,376.

CASE 22. Mrs. H. M., C. F. D., age 26. Never pregnant. Fairly well developed. Menses once for three days when 18 years old. Amenorrhœa then until 20, after which periods came every four weeks to four months preceded by severe abdominal pain and swelling in the breasts. Pain and swelling every month regardless of flow. Menstrual discharge often a pale bloody mucus and at times a white discharge only. During the past six months but two periods. The thyroid gland is small. The uterus has been dilated and curetted without benefit. The vagina is very narrow and constricted, the cervix long, narrow, and infantile; the corpus very small and hard; appendages not palpable. She has never experienced hot flushes and is not nervous, though weak and readily fatigued. Her blood-pressure is low, the diastolic being again out of proportion, so that the pulse-pressure is elevated. Systolic, 108 to 110 and stable; diastolic, 50 to 70 to 42; pulse pressure, 60 to 40 to 66. This is more probably due to the heart. Here there exists a diffuse systolic thrill at the apex and a slight presystolic murmur at the mitral area. This is a case of hypoplasia genitalis, not primarily an ovarian dysfunction. The rest of the ductless chain was never strongly influenced by the ovary.

CASE 23. C. C. H., 595,290, age 23. Never pregnant. Slender but not undernourished. Menses began at 14 and by 17 were regular, lasting 4 to 5 days. At 18 she had a laparotomy, since which time the periods have been irregular, every 4 to 8 weeks, 1 or 2 days, pale and often only a stained mucus. The thyroid gland is very small. The vagina is narrow and constricted, the cervix small and virgin, the corpus very small, firm, retroverted. The appendages are not palpable. This patient has no symptoms suggestive of menopause, either psychic or somatic. The case is one of ovarian deficiency, secondary to disease or operation, with *atrophia genitalis*. The other ductless glands came under the ovarian influence but for a short time only. Systolic tension showed a slight irregularity, 125 to 140, but the diastolic was relatively high, 90 to 110, so that pulse-pressure was low, 35 to 30.

CASE 24. Mrs. L. B., age 23. One child by cæsarean section at 17. Previous to this she had menstruated every 4 weeks, for 8 or 10 days, profusely, evidently an expression of ovarian hypersufficiency. After her labor she had a definite metrorrhagia. At 19 the right ovary was removed, at 22 the left ovary with the uterus. When she came under observation she was a widow, slender, undernourished, unable to support herself. Since the last operation she had been extremely nervous and emotional, talkative, unable to sleep, had frightening dreams, was timid, particularly fearful of crowds. Physically she suffered from backache and pains in the legs, with moderate hot flushes. The thyroid was slightly enlarged, the eyes somewhat protuberant and there was a tremor. She denied any neurosis previous to her castrating operations.

This case represents a marked psychic reaction to sudden ovarian cessation after an evident hyperoophorism, with a probable neurotic tendency previously. She improved very satisfactorily under corpus luteum extract and is now working steadily. Her blood-pressure showed no hypertension at any time and but slight irregularity, the systolic pressure coming down from 130 to 98 within the first month of treatment.

CASE 25. Mrs. R. C., C. C. H., age 29. One pregnancy. Obese; weight over 200 pounds. Menses normal until 20 years. At that time she sustained a post-abortion infection and was in bed two months. Since then menstruation had been regular but very scanty and for one or two days only. The thyroid gland was not palpable. She has grown very obese and was in good health. She had noticed slight hot flushes occasionally but none during recent years. Never nervous. Examination of the pelvis showed a very small uterus and appendages scarcely palpable. Blood-pressure was normal; systolic 120 to 135, diastolic 70 to 90. This case presents a picture suggestive of dystrophia adiposogenitalis, and represents ovarian deficiency in youth secondary to probable ovarian abscess, with accompanying dysfunction on the part of other ductless glands.

CASE 26. Mrs. K. W., age 23. Never pregnant. Very obese since girlhood. Now weighs over 200 pounds. Menses began at 11 but have never occurred oftener than three or four times a year, scanty and lasting two or three days. Occasionally she had bled twice monthly for a day at a time. Pelvic examination showed a genital hypoplasia, and the thyroid gland was not palpable. She was docile and good-natured, far from being nervous or temperamental, and had never experienced vasomotor disturbances. Systolic tension varied between 120 and 135, diastolic between 80 and 90. This case also suggests dystrophia adiposogenitalis, and represents ovarian deficiency from the beginning, probably associated with thyroid and hypophysis hypofunction.

CASE 27. C. C. H., 577,171, age 48. Seven children, 1 abortion. Fairly well-nourished. Menses regular and normal until three years before; then irregular for several months. Amenorrhœa for 7 months, except metrorrhagia during past 5 weeks. At the time she came under observation she was bleeding. Hæmaglobin, 68 per cent. Scandanavian, temperament phlegmatic. Had noticed hot flushes for a year but they were not marked. Blood-pressure, 120 to 130 systolic, 70 to 85 diastolic, giving a somewhat increased pulse-pressure. Low tension in this case may have been due to the relative anæmia. Hæmorrhage did not cease and hysterectomy was done. The uterus was 3 inches deep, and showed fibrosis; the mucosa was hyperplastic; the ovaries were atrophic. High arterial tension may have obtained before the onset of metrorrhagia, but, as it was, this case must be classified with the few showing low tension during the menopause.

CASE 28. C. C. H., 580,380, age 39. Thirteen children. Well-nourished and developed. Two years ago had been treated for "goiter poisoning." Was then nervous, with cardiac palpitation and exophthalmos. This not evident now, except a rapid quick pulse and moderate nervousness. Menstruation had always been normal except for a profuse uterine hæmorrhage 3 years ago. Amenorrhœa for the past 10 months except for two short periods during the past 30 days. Hot flushes, perspiration and headache had been present moderately for 1 year. Diarrhœa at times. Blood-pressure varied but slightly, systolic 118 to 130, diastolic 70 to 80. But here again the hæmaglobin was reduced to 60 per cent.

Subsequent operation showed the uterus to be small, hard and markedly fibrous, with atrophic mucosa. The left ovary was very cystic, the right small and shriveled.

CASE 29. Chart 17. C. C. H., 594,376, age 43. Two abortions. Small, underdeveloped and undernourished. Menses were always regular and profuse and during recent years she suffered from menorrhagia. She had observed hot flushes, headaches and dizziness for two years but was never particularly nervous. One year ago a large uterine fibroid was removed, since which time she had not menstruated. The thyroid gland was very small. Systolic tension varied from 120 to 130, diastolic was proportionately higher, 90 to 95, giving a relatively reduced pulse-pressure. Tested with adrenalin this patient showed no reaction whatever; with pituitrin there was a moderate tension disturbance, tending rather to reduce pulse-pressure. With neither were hot flushes excited.

From this study we may conclude that —

1. The menopause is a functional derangement on the part of various glands of the endocrine system subsequent to the cessation of the ovarian secretion.

2. On this basis may be explained the psychic and somatic manifestations of the menopause.

3. The vasomotor disturbances represent an instability of arterial tension.

a. In the majority of cases this takes the form of a vacillating hypertension, both systolic and diastolic.

b. The diastolic pressure is not elevated proportionately to the systolic. This produces an increased pulse-pressure.

c. Hot flushes, sweating, and other vasomotor symptoms are directly created by the vacillations in arterial tension.

d. In a minority of cases there is arterial hypotension and here also the systolic and diastolic pressures are out of proportion.

4. Hypertension is apparently due to a relative oversufficiency on the part of the hypophysis or the adrenals.

5. The psychic symptoms are apparently influenced by thyroid dysfunction; in the majority of cases a hyperthyroidism, in the minority, a hypothyroidism.

6. The administration of the missing hormone, represented by the extract of corpora lutea from animals in early gestation, brings about a gradual restoration to normal of the blood-pressure with disappearance of the mental symptoms.

7. This reduction of blood-pressure by organotherapy together with the disproportionate systolic and diastolic rise is offered as evidence that the hypertension is a functional one and not due to organic changes.

8. Blood-pressure estimation is essential, as a means both of measuring the degree of menopause disturbance and of controlling its therapy.

9. An occasional pressure reading is of little or no value. Tension must be determined at frequent intervals, preferably daily until improvement is well under way.

10. The significance of functional hypertension as a factor in uterine hæmorrhage is obvious and will be made the subject of a subsequent report.

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OBSTRUCTIVE CALCULOUS PROSTATE[1]

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FROM personal experience with three cases of calculous prostate causing urinary obstruction and from a study of the cases to be found in the literature, I believe that this condition is one which occurs more frequently — the pathology comprising prostatism with a varying amount of residuum, produced by partial or complete obstruction — than is generally appreciated. I believe that many of us massage and otherwise treat prostates for chronic prostatitis with and without success; those that do not come to a successful termination may possibly not have received benefit, owing to the presence of calcareous deposits within the parenchyma of the gland, which destroy tissue and which are replaced by a fibrous substance that contracts and distorts the contour of the internal urethral meatus, producing obstruction.

The type of case which I offer for discussion is not to be confounded with the condition described as "secondary prostatic calculus," in which a renal or vesical calculus becomes lodged in the prostatic urethra, wherein a constant deposit upon it of urinary salts changes it from a small calculus to one of considerable size, which oftentimes juts into the bladder and is usually palpable by rectal examination.

The total number of cases of calculous degeneration of the prostate reported to date must be considerably over 50. In 1914 Glaesel (1) was able to find notes of 54, and this list does not include others collected by V. C. Pedersen (2) one year earlier. In studying these cases one finds it somewhat difficult to select those with total and permanent obstruction. Many with a history of severe urethral stricture have to be rejected, while in others we find histories of temporary or subtotal obstruction. It seems safe to assert that at least 10 cases may be selected as examples of virtually complete obstruction.

The first of these cases was published in 1834 by Lartet (3) and was practically an autopsy case, as the patient was under observation but a few days, during which it was impossible to catheterize him. The gland contained a number of facetted stones. There is no mention of stricture. The organ was said to be gangrenous, and there was also a black area in the bladder.

We find no other cases until 1867 when Manzoni (4) reported one admitted for complete urinary retention. It is said that a correct pre-operative diagnosis was made. Intrarectal prostatotomy was followed by the difficult extraction of a stone, but a permanent fistula remained. The patient was only 35 years old. Robin (5) in 1873 reported a case, aged 70, in whom complete retention followed a debauch. Relief was obtained by puncture but death resulted in a few days. There was typical hypertrophy of the prostate, and the presence of a considerable number of very small stones may not have played any role in the obstruction. In 1878 Jean (6) reports a case in which death

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occurred in the course of attempts to relieve retention. This case was of the same type as the preceding; a very large prostate containing lacunæ filled with small black stones. Age of patient 63. One year later Hautesson (7) reported a case in a man of 66 in which prostatic calculi were known to be present, as such had been passed from time to time. The catheter was required now and then, probably before the stones escaped from the organ. Not all of these were voided externally, for some passed into the bladder, there to form vesical calculi, for which litholapaxy had once been performed. Per rectum the prostate felt soft and compressible, most of the stones having doubtless escaped from a cavity in the gland. This case may not belong properly in the series, although only the occasional escape of the stones could have prevented permanent obstruction. In 1909 Cholzoff (8) reported a case aged 68, obstruction having been due to the stone itself. Rectal examination revealed an enlarged prostate which contained numerous concrements. A perineal prostatectomy was performed and almost the entire gland was removed because of the presence of the latter. Ekehorn's (9) case in a man, aged 69, reported in 1908 gave history and symptoms of ordinary enlarged prostate leading to catheter life. A diagnosis of prostatic calculus was made after suprapubic cystostomy, and 40 stones were curetted from the gland after dilatation of the sphincter. Death followed four months later from marasmus, when both kidneys were found atrophic. The patient had developed a pelvic abscess as a result of intervention. In 1909 Thomas (10) reported two cases. One was a typical enlarged prostate in a man of 63 ending in retention (the surgeon could pass only No. 6). Suprapubic cystostomy revealed the presence in the prostate of a pocket of stones. Incision wound infected and a counter-opening was made in the perineum. The second case was similar (age 62) and the bladder already septic. Eight small stones were removed through a suprapubic opening and the patient recovered.

In studying these cases, it is interesting to note that in several — namely, those of Robin, Jean, and Thomas (second case) — the hypertrophic increase in the size of the gland was apparent and justified the operation of suprapubic incision and prostatectomy, and the calculi in these cases evidently were incidental to the senile hypertrophy.

The first case of J. Lynn Thomas (10), as cited in brief, more closely resembles the cases encountered by me, except as regards the enlarged gland. Two of the cases reviewed, that of Thomas and one reported by Ekehorn, were followed by post-vesical abscess, and, as will be shown later, one of my cases had a similar condition; and it may be possible that in our endeavor to do a thorough operation we broke through into the fascia and carried infection thereto.

My first case operated upon was in a man, 42 years of age, who gave a history of urinary trouble extending over a period of twelve years: for past four years he had been on catheter life. Cystoscopic examination was negative, other than that the vesical sphincter had to be dilated to admit the instrument. The hypertrophied, trabeculated bladder held 1,920 cubic centimeters. By rectal examination the prostate was apparently normal and was not sensitive to palpation and there was no evidence of cord lesion. Pre-operative diagnosis was not made and the patient was so informed. Suprapubic incision was consented to as an "exploratory measure." The internal urinary meatus was of the pinhole type and was dilated with the index finger with difficulty; it finally gave way, and in the attempt to enlarge it, the finger broke through into a sac of small stones which, when removed, left practically no prostatic tissue. The patient made a good recovery and has a normal urinary function and no residuum.

In another case, in a man 48 years of age, there was practically the same history of urinary trouble for a long period of time, the same failure of pre-operative diagnosis and the same pathological conditions discovered at operation The patient did well until the tenth day when he developed pneumonia and died. At autopsy an abscess was found "under the floor of the bladder," and the pulmonary lesion was classified by the pathologist as a septic pneumonia resulting from the abscess in the vesicorectal region.

The third case seen differed from the other two in that the most important symptom with him was a terminal hæmaturia, accompanied with the usual history of increasing urinary symptoms. Examination, tending to the arrival at a pre-operative diagnosis, was as unsatisfactory as in the other cases. An "exploratory" showed the same type of obstruction and due to the same pebbly prostate. The patient was discharged from the hospital before his

suprapubic wound was closed, and, when I saw him six months following, he was passing no urine by the urethra but all of it through his suprapubic fistula; it did not dribble and to certain extent he had control of his urinary function, as voluntary contraction would give a projectile stream; a catheter or sound passed to the bladder had but limited motion and no urine would run through the catheter. It is needless to remark that I was displeased with the result and requested him to return for further treatment. In going into the bladder, by following down the suprapubic sinus, I found that the sound and catheter passed into the sac of the prostate which had roofed over and thus closed the internal meatus. Cutting through and dissecting out the sac, I placed in a large caliber retention catheter, allowing it to remain until the suprapubic wound healed. From last reports all was well.

"Phosphatic calcareous deposits may incrustate upon the mucous membrane of the prostatic urethra extending into the follicles favored by morbid conditions of the mucosa and ammonical deposits of urine, but true prostatic calculi are developed primarily in the follicles of the gland and are derived from the precipitate of salts of the prostatic secretion" (Chetwood).

The symptoms given by Chetwood are "those of prostatitis and urinary obstruction, mainly pain and dysuria sometimes accompanied by hæmaturia and purulent urine."

In all cases the history of urinary disturbance extending over a period of several years was revealed, characterized by painful and frequent urination with and without blood; in only one of my cases was a history of the passage of gravel given. Examination, as stated, led to nothing except an obstructive condition at the neck and in no wise suggested the presence of calculi. I anticipate the interrogation — "What difference does it make whether calculi are present or not so long as the indication to remove the obstruction is present?"— and I grant this question is pertinent; but in the present age of exact urinary diagnosis, it is disappointing to expect to find simple fibrotic prostate and distorted sphincter and instead find a stone quarry.

This subject has been advanced by me to try to bring out in the discussion the question of diagnosis, likewise of treatment other than perineal or suprapubic removal of calculi and obstruction, perhaps by means of the operative urethroscope or cystoscope in the hands of experts. Removal of the obstructions in these cases was my object and while they were approached suprapubically, in the future I will attack all small fibrotic prostates, with or without stones, through the perineum; as it is most difficult for me to dig out a small gland from above.

CONCLUSIONS

In the cases seen by me and in those reported, the pre-operative diagnosis of the true pathology was not made except in Manzoni's case (4). Microscopical study of the urinary sediments gave no clue to the diagnosis.

Hæmaturia was present in one of my cases and in some of the cases reviewed, and with the absence of other definite causes in obstructive conditions may act as a diagnostic lead.

Difficulty of catheterization and evident contracture of the neck should be considered suspicious as occurring in calculous prostate.

The history of gravel is important, as in two of my cases such a history was obtained and Hautesson mentioned it in his case (7); the other authors reviewed made no mention of it.

The textbooks emphasize the finding of a "small sac of stones" by rectal palpation; this was not so in my cases and no mention was made of it by the authors reviewed.

From conversation with several X-ray men, I have learned that occasionally calculi of the prostate are discovered but, as far as they know, it is not a routine practice among genito-urinary men and it would seem to me that this aid to diagnosis should be taken advantage of when cases are slow to respond to ordinary treatment.

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LARGE SOLITARY AND MULTIPLE CYSTS OF THE KIDNEY[1]

By JOHN H. CUNNINGHAM, JR., M.D., F.A.C.S., Boston

SOLITARY and multiple large cysts of the kidney are surgical rarities and are of interest because of their lack of diagnostic features and because, in most instances where they have been encountered, nephrectomy, rather than a more conservative operation, has been practiced. Having operated upon 4 patients with this disease, I wish to make brief mention of them and the other clinical cases occurring at the Boston City Hospital as well as of the postmortem specimens recorded at the Boston City Hospital and at the Long Island Hospital, Boston.

Speaking in general, cysts of the kidney have a large variation in size and number and may be congenital or acquired. The acquired form is the only one that concerns us in this connection. Acquired renal cysts are usually small, multiple, and occur most commonly in kidneys which have undergone structural changes whereby tubules have become obstructed, and, urinary secretions continuing without an outlet, retention cysts result. Among the more commonly recognized renal conditions with associated cystic changes may be mentioned chronic interstitial nephritis, arteriosclerosis, cicatrices from infarcts, deposits of urinary salt in the organ, and inflammatory conditions of the renal pelvis extending to the pyramids and obstructing or obliterating the tubules. The type of cyst associated with the above-mentioned condition is usually small, multiple, and the diseased condition of the kidney upon which the cysts are dependent is clinically obvious from the general manifestations and changes in the urine.

It is the cyst of considerable size, producing an abdominal tumor and occurring in an otherwise normal, or but slightly changed kidney, which concerns us from a surgical standpoint. The relation in origin of the large serous cyst involving but one kidney to the small bilateral cysts associated with marked kidney changes just mentioned and to congenital polycystic disease is not clear. There is much discussion in regard to the pathogenesis of large renal cysts, which matter has been presented fully to this society by Caulk and will not be considered here.

Large, solitary serous cysts, producing abdominal tumors, are very uncommon and are probably due to some undiscovered obstruction in the uriniferous tubules and the continued excretion of urine. They are generally unilateral and are considered by those who have studied the subject to be large retention cysts.

That they are rare is seen from Morris' report of 2,610 autopsies at the Middlesex Hospital, London, in which series there is recorded 5 cases. In 4,250 autopsies at the Boston City Hospital and Long Island Hospital, Boston, I have been able to find but 34 instances of the type of cyst under consideration. From the literature it is found that Israel encountered but 1 instance in 297 surgical affections of the kidney. Simon in 1906 could find but 52 cases, and Brin in 1911 added but 1 more case. Aside from these series, single cases have been recorded by Récamier, Blake, Zaccarini, Sarkissiantz, and Fowler, Giuliani reported 2 cases, 1 containing blood, and the other serum; and Brockenheimer records a cyst which he removed from a horseshoe kidney.

These cysts have been more commonly found in females than in males. Albarran is the only authority who shows a slightly higher percentage in the male. Fowler, in a series, reports 22 females and 12 males, and Tuffier gives a proportion of 20 females and 3 males. Of the 4 cases which I have operated upon, 1 was a male, and 3 were females. Of the 34 autopsy cases in this report, 13 were males and 21 females.

Fowler in his series found the right kidney affected in 22 and the left in 10. In my series of 34 autopsied specimens and the 4 clinical cases, the right kidney was involved in 20, the left in 16, and it was bilateral in 2.

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The type of cyst under consideration occurs in adult life, there being but 1 case, that reported by Wagner, which was four years of age, appearing as the exception. Simons could find but 7 patients under 20 years of age. Fox records a patient 70 years old, and 1 of my patients was 72 years of age.

In regard to the *location of the cysts*, they are usually situated at one or the other poles of the kidney. Simon, in his series of 52 cases, found 18 at the lower pole, 8 at the upper pole, and 8 in different parts of the body of the kidney. Terrier found 6 in the upper pole and 1 at the lower pole. Récamier's case showed the cyst to be at the upper pole of the kidney, but Fowler's, Blake's, Sarkissiantz's, Guiliani's (2 cases), Zarcarini's, and 10 out of my series of 34 autopsy specimens were in the lower pole. Of the remaining autopsy specimens in my series, 18 were in the upper pole and 6 in the body of the kidney. Of my 4 clinical cases, 3 were in the lower pole and one had cysts in the body of the kidney, as well as at both poles.

The *size of the cysts* has varied within a very wide range. Rendu records a case of a cyst containing 10 litres; and Morris one which practically filled the abdominal cavity and weighed 16 pounds. One of my cases had a cyst containing over two bucketsful of fluid. The majority of the cysts have been about the size of an orange. Rarely the cysts have communicated with one of the renal calices; but in most instances the renal surface of the cyst has been smooth, and the cyst wall of about the same thickness at the point of attachment as elsewhere.

Case mentions a cyst of considerable size, the walls of which had undergone calcification, as was the case in one of my post-mortem specimens, in which instance the cyst cavity also contained several small calculi.

The *content of the cyst* has usually been found to be of a clear, serous character, but some have been urinous, turbid, gelatinous, bloody, and caseous. The fluid usually contains albumin and urea, and colloid material has been found in some, as well as phosphates, sulphates, and chlorides. The specific gravity has been between 1,010 and 1,020.

Histological study of the free portion of the cyst wall has resulted in diverse findings. Le Dentu, Terrier, Follin, and Duplay have described the wall as consisting of fibrous or connective tissue without an epithelial lining, while Lejars has observed flattened cells, and Cornil, Delkeskamp, and Babinski flattened and cuboidal cells lining the cysts. Bonneau and Hartmann record a cyst lined with cells containing elongated nuclei resembling endothelium in certain areas and absent in others. Papin and also Lecène have found a cellular lining in the cysts. Hyaline changes and unstriped muscles and nerves, as well as numerous blood-vessels, have also been noted. Various changes have been recorded in the renal parenchyma beneath the cyst by Terrier, who remarks that the tissue looks normal in the gross, but histologically there is evidence of nephritis. Others have found the tissue thickened and some of the tubules show a slight degree of fatty infiltration and inflammation. The microscopical study of post-mortem tissue, in my series, shows that the tubules may be compressed, dilated, or distorted, with interstitial changes similar to those seen in nephritis. A study of renal tissue in many of the post-mortem specimens showed these slight interstitial changes, while other areas, some distance from the cyst, were quite normal. There were occasionally sclerosed and hyalin glomeruli and thickening on the walls of the vessels. The tubules were sometimes dilated or contracted and contained occasional hyaline casts, granular coagulum, and in some there were areas in which the epithelium was granular or disintegrated.

The *symptoms* dependent upon large solitary or multiple cysts are ill-defined, and unless there is coexisting disease, such as calculi or new-growth, which produces changes in the urine and the renal function, the urine remains normal and the symptoms are most obscure. Tumors arising in the lumbar region and obviously of renal origin have been noted in some of the cases, and in others the tumor has been observed, presenting not unlike a large gall-bladder or ovarian tumor, for which condition it has more than once been mistaken. Lumbar pain has rarely been a

prominent symptom, but in some of the cases in which the cysts were very large there has been pressure symptoms and a sense of intra-abdominal weight similar to that in any intra-abdominal tumor. In the uncomplicated cases the urine has remained quite normal and the renal function unaltered. When these objective and subjective symptoms have been present, the diagnosis has usually been hydronephrosis, gall-bladder disease, or an ovarian tumor.

From the *diagnostic standpoint*, a complete examination of the urinary tract by cystoscopy, ureter catheterization, renal function tests, and pyelography can eliminate hydronephrosis, but in most of the cases these methods of examination have not been employed and the true condition has only been discovered at the time of operation; the operation usually being undertaken because of the presence of an intra-abdominal tumor, or because of the mistaken diagnosis of hydronephrosis.

In regard to *treatment*, several procedures have been practiced. One cannot help but feel that too often nephrectomy has been done when the kidney might have been saved. Aside from the loss of an organ, with but little if any impairment of function, it is important to realize that the other kidney has not undergone a vicarious hypertrophy, because of the nature of the malady, and is in no condition to undertake the work suddenly thrown upon it by the loss of its mate. In this connection it is of interest to note that in Tuffier's series, 11 cases out of 24 died following nephrectomy. Quénu records 5 deaths in 7 nephrectomies, and Legars 7 deaths in 16 patients so treated. In instances where the cystic kidney is much destroyed, compensation will have taken place, which is easily learned by the routine preoperative study of the renal condition, and under such existing conditions nephrectomy may be the operation of choice.

In cases where there is little or no impairment of renal function, resection of the cyst, partial nephrectomy, and emptying the cyst content and sewing the cyst sac to the skin have been practiced with good results.

Resection of the cyst seems to me to be the operation of choice. It has been done successfully by Tuffier, Ricard, Récamier, Albarran, and Bardenheuer, and in 3 of my cases. In 2 of my cases the sacs were incised where they joined the kidney tissue, as there was no real line of cleavage between the sacs and the renal parenchyma. The cysts could, however, be freed from the renal parenchyma by gentle traction, leaving a bleeding surface which was satisfactorily brought together by mattress sutures. In another of my cases, in which the cyst was of tremendous size, occupying the whole retroperitoneal space, the sac was simply cut away from its attachment to the lower pole of the kidney and no attempt was made to remove that portion adjacent to the renal tissue. In the fourth case, nephrectomy was done because an obvious hypernephroma was present in the kidney tissue above the cyst.

Albarran and Imbert record 5 cases in which partial nephrectomy was successfully carried out, and Morris recommends this procedure when the renal tissue is spread out over the cyst wall.

Emptying the cyst content, and suture of the edges of the cyst to the skin is the least severe operation, and is of value when the patient is in poor condition, or the cyst very large. This procedure should, however, be employed only when it is not advisable to resect the sac or do a partial nephrectomy, as Tuffier records 3 cases out of 8 in which intractable fistulæ resulted from this operation, 1 later requiring nephrectomy, and Morris records 3 persistent fistulæ out of 5 patients so treated. Lejars mentions 7 patients treated by puncture, with 3 cures and 4 deaths, and Simon 3 patients with 1 cure and 2 deaths. Although my case which had the tremendous sac, recovered, it would have been wiser, perhaps, to have employed simple drainage of the sac, without attempting to remove it, and it is in this type of renal cyst, if any, that simple drainage should be employed, in my opinion.

CASE 1. Female, age 58, entered the Long Island Hospital in March, 1911, with nothing in the past history of importance, except that she had attacks of jaundice, which were supposed to be dependent upon gall-stones and for which she had refused operation.

The physical examination was negative, except for a slight fullness in the right upper quadrant of the abdomen which was not tender on pressure. The urine examination was negative. The patient was habitually constipated. About four weeks after entrance to the hospital the patient had a typical attack of gall-stones, associated with jaundice and clay-colored stools, and bile appeared in the urine. The usual signs dependent upon this condition were present.

Operation. A right rectus incision was made and the gall-bladder found distended. To the outer side and below it, behind the peritoneum, was a mass about the size of an orange which appeared to be attached to the lower pole of the kidney. The gall-bladder was removed, following which an incision in the peritoneum about one inch from the outer border of the ascending colon was made. The peritoneum with the colon was stripped upward and inward, exposing the kidney. Attached to the lower pole there was a cyst, about the size of an orange, the walls of which contained many blood-vessels. The remainder of the kidney appeared normal. The cyst was punctured, with the escape of a straw-colored fluid. An incision was made in the kidney capsule, near the junction of cyst with the kidney, and the attachment of the cyst to the kidney dissected away, leaving a depressed, oozing surface, which was brought together by mattress sutures of catgut. A stab wound was made into the loin, and the retroperitoneal space drained with a cigarette drain. The peritoneal incision was united, replacing the ascending colon. The abdominal wound was closed, except for a small drain at the upper portion of the wound, running to the gall-bladder area. The patient made an uneventful recovery (Fig. 1).

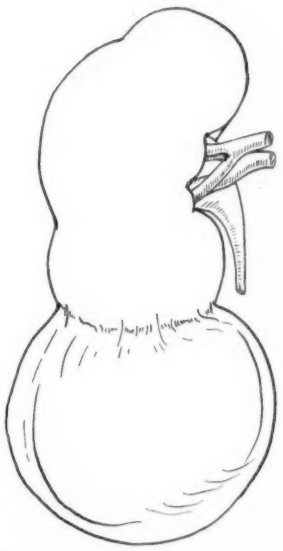

Fig. 1. Case 1, kidney with cyst. Cyst resected.

Case 2. Female, age 72, referred by Dr. George Muttart, with a negative past history, except that she had had pneumonia 32 years ago. She is the mother of four children. Two years ago she had what was supposed to be a gastric upset, associated with vomiting and pain on the right side, in the region of the gall-bladder. A small lump, the size of a lemon, could be felt and was supposed to be a distended gall-bladder. This is said to have disappeared in a few days and did not return until three months ago, when the patient noticed a swelling in the region of the gall-bladder, without accompanying symptoms, until a few days later, when she had blood in the urine for one day, without pain. The patient was seen by Dr. Muttart, who said that the swelling in the region of the gall-bladder was the size of a small orange and that the urine contained a small amount of blood; the examination being otherwise negative. Three months later there was an attack of painless hæmaturia lasting one day, and the swelling in the right upper quadrant had increased in size. When seen by me, December 7, 1915, the abdomen was negative, except for a swelling the size of a small grapefruit in the region of the gall-bladder, extending downward below the umbilicus, movable, not tender, and elevated above the surface one inch throughout the right upper quadrant. The urine was negative, being 1,010, acid, and without albumin or sugar; sediment showed but a few epithelial cells. The remainder of the physical examination was negative. The cystoscopic examination showed the bladder capacity to be 12 ounces. The bladder wall and ureteral opening were normal; catheters were passed to each kidney without meeting obstruction. The urine obtained from the right side was less than from the left side, and both were normal in character. The phthalein test showed 25 per cent from the left kidney and 5 per cent from the right kidney in one hour. Until these findings were made in regard to the renal functions the opinion was held, by several who had examined the tumor, that it was of gall-bladder origin.

Operation. December 11, 1915. A right rectus incision was made and the abdomen opened. All the abdominal organs were normal. The tumor was retroperitoneal. The peritoneum was divided about one inch from the edge of the ascending colon and the peritoneum stripped forward toward the median line, exposing the kidney, which showed a cyst the size of an orange at the lower pole and a tumor growth above the hilum. The mass was freed from its bed and the renal vessels and ureter identified. The ureter was clamped, tied, and divided about one-half inch from the kidney pelvis. The renal vessels were tied separately and divided. The specimen, Fig. 3, consisted of a cyst at the lower pole, unruptured, and containing a clear serous fluid and the tumor growth. Histologically, it was

a papillary adenocarcinoma, probably of adrenal origin.

The peritoneal fold at the line of incision was united by a continuous catgut suture, replacing the ascending colon in its normal position. The retroperitoneal space was drained, through a stab wound in the loin, by a piece of rubber dam. The peritoneal incision was closed without drainage. The patient made an uneventful recovery. The drain was removed on the fourth day, and the patient sat up on the tenth day and left the hospital on the twelfth day. Since the operation she has been perfectly well.

CASE 3. Male, physician, age 63, referred by Dr. T. Chittenden Hill, February 9, 1909, with a past history of having passed uric acid calculi twenty years ago, and during the subsequent ten years; there being five attacks in all. Ten years ago the pain became so severe in the left lumbar region that he was obliged to give up his practice. He consulted many prominent men in England and on the Continent, as well as in this country. The general opinion was held that he had an excess of uric acid and a uric acid diathesis. All X-ray plates of the kidney region were negative, as well as several cystoscopic examinations. The pain in the left lumbar region persisted, and when seen by me he was stooped over, in which position he carried himself constantly, on account of the persistent pain, and it was only by the use of morphia that he could get about. The physical examination showed him to be obese, with a moderate arterial sclerosis, but the general condition was otherwise negative. Locally, the external genitals were normal. Neither kidney region was tender, and neither organ could be felt.

The urine was clear, specific gravity of 1,015, strongly acid, and without albumin. There was no visible sediment and the microscopic examination showed a few abnormal and normal blood-corpuscles and an occasional leucocyte; many uric acid crystals. Cystoscopic examination and ureter catheterization revealed nothing abnormal. Indigo carmine test equal on both sides and quite normal. An X-ray examination by Dr. Percy Brown showed the kidney to be increased in size and a concretion of irregular shape in the pelvis of the left kidney.

Operation Charlesgate Hospital, February 20, 1909. Lumbar incision. The perineal fat was abundant and tough, suggesting an old chronic process. As the fat was separated, a cyst, bluish in color, with vessels running in every direction over its surface, came into view. It was the size of a large orange, originating from the lower pole of the kidney. This cyst was tapped and a clear straw-colored fluid escaped. The sac was opened and the base was found to make a depression in the kidney about one and one-half inch in diameter and to sink into the kidney about three-fourths of an inch. The fat was freed from the superior pole of the kidney, where another cyst, similar in character, and the size of a large lemon was found. This cyst was also tapped and dealt with in the same manner. On freeing the anterior surface of the kidney, another cyst of the same character, the size of a small lemon, was found and treated in the same manner. A small cyst, the size of a Concord grape, was found situated between this last cyst and the cyst at the upper pole. This was ruptured and contained the same kind of fluid as the others. The stone could be felt in the pelvis of the kidney from the anterior surface. In freeing the posterior surface of the kidney, another cyst, the size of a large lemon and with the same characteristics as the others, was found and dealt with. It was impossible to reach the pelvis of the kidney posteriorly, as the kidney could not be delivered on to the loin. The stone was reached by boring through the bottom of the cyst on the anterior surface, and was removed with difficulty, the stone being firmly adherent. The walls of the cysts, about 2 or 3 millimeters in thickness, bled freely from their cut edges. Each cyst in turn was cut away from the kidney substance and the oozing depression obliterated by mattress sutures of catgut. After obliterating these cyst areas with the sutures, all bleeding was controlled and a small gauze wick was placed over the pelvis of the kidney on the anterior surface, and a similar one to the same point on the posterior surface. The muscles were united by a continuous chromic gut suture, and the external wound by interrupted silkworm-gut sutures around the wick. Under ether the right kidney could be palpated, somewhat larger than normal. The stone was shaped like an Indian arrow head, dark brown in color, and covered with small spines (Fig. 2) A and B.)

The patient made an uneventful recovery, and the urine has remained normal up to the present time, except for the presence of uric acid crystals. The patient has all the manifestations which go with a severe uric acid diathesis. Changes have taken place in the spine for which he has been under the care of an orthopedic surgeon.

CASE 4. Female, nurse at Long Island Hospital, age 29 years. Presenting nothing of interest in the past history. In the early part of the winter of 1906, she complained of a sensation of fullness and a swelling in the right upper portion of the abdomen. An examination in November showed a tumor the size of a grapefruit, and elevated about two inches above the surface, the center of which was about on the level of the umbilicus. There was a sensation of fullness extending beyond the mid-line, well on to the left side, and downward to the brim of the pelvis. The only tympany, by percussion of the abdomen, was in the stomach area and in the left flank. Aside from a slight diminution in the 24-hour amount of urine, nothing abnormal could be found in the remainder of the examination. It was believed that the tumor was probably an ovarian cyst. An operation was advised, but refused. She continued her duties and refused examination until the early part of January, 1907, when it was found that the tumor had increased in size so that it

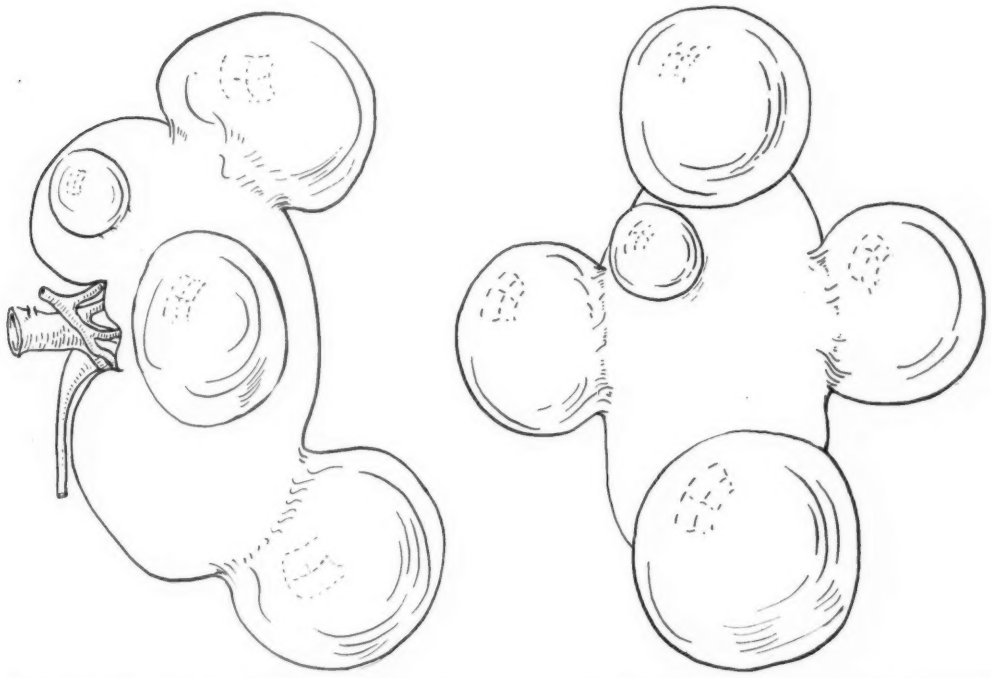

Fig. 2, a (at left) and b. A, anterior view of kidney with multiple cysts. At right, superior view of kidney. Cysts resected.

resembled an eight months' pregnancy. There was nothing else abnormal in the examination, although she had complained of constipation. The sense of fullness in the abdomen and the difficulty in defæcation led her to consent to operation.

Operation, January 14, 1907. A median incision extending from the umbilicus downward almost to the symphysis. Inspection showed that the pelvis could not be entered and that the tumor mass was behind the peritoneum. The incision was extended upward, almost to the ensiform. Through this extensive incision the inspection of the abdomen showed that the peritoneum had been elevated almost to the abdominal parietes, and that all the small intestines had been crowded to the left side of the abdominal cavity. The stomach had been forced upward, and the transverse colon was so flattened by retroperitoneal pressure that it could hardly be distinguished. The retroperitoneal mass occupied the whole retroperitoneal space from beneath the liver, downward, filling the pelvis, and was more prominent on the right side than on the left. An incision was made parallel with the transverse colon, about one inch above the superior border, which brought the incision about the midpoint of the abdominal cavity. The peritoneum was stripped upward and the cyst tapped, with the escape of over two bucketsful of a blood-tinged serous fluid. The sac was then separated from the peritoneum in front and could be freed entirely from the left side of the abdomen, but was fixed at the lower pole of the right kidney, where it formed a sac-like insertion. The sac was divided at this point, and the dissection carried downward, separation being easy until the brim of the pelvis was reached. The sac could not be separated from the sigmoid or lateral walls of the pelvis. In order to have freer access to the pelvis an incision parallel with the transverse colon at a point one inch below its inferior border was made, but the pelvic portion of the sac could not be removed; the sac was therefore cut off slightly above the brim of the pelvis, purse-stringed, and brought to the lower portion of the abdominal wound, where it was sewed to the peritoneal edges of the transverse colon and caught to the psoas muscle by four interrupted catgut sutures, thus closing the retroperitoneal space and fastening the peritoneum to the underlying structures. The abdomen was closed, except for a space at a point over the transverse colon where a large wick was placed, and for the area where the saw was brought to the surface at the lower end of the wound.

Dr. S. B. Wollbach, at that time pathologist at the hospital, witnessed the operation, and was of the opinion that the cyst was of renal origin and

possibly due to some congenital defect. The remainder of the right kidney appeared normal, as did the left kidney which could be easily seen and palpated. Dr. Wollbach examined the sac and found it to be fibrous tissue, with an epithelial lining, of a character that gave further evidence that it was of renal origin.

The patient made an uneventful recovery for eight days, when a fæcal fistula developed in the drainage area. On the fourteenth day a piece of gangrenous intestine presented in the wound, which was drawn out and found to be the transverse colon. This piece of gut measured fourteen inches and apparently sloughed out from lack of blood supply, as we had feared it might at the time of operation. The patient continued to improve in general condition and fæces to escape freely through the wound.

Six weeks following operation, and while consideration was being given to the method of re-establishing the continuity of the intestinal canal, the patient had a movement by rectum. Movements by rectum continued to take place, and the fæcal discharge from the wound began to decrease, and at the end of twelve weeks there remained but a small sinus from which a seropurulent material escaped, and all the fæces were passed per anus. The sac had previously become obliterated, having been treated by occasional injections of iodine.

The patient left the hospital in fairly good condition and returned to her duties as a nurse on July 29, 1907, and graduated in January, 1909, in excellent condition, except for a small persisting sinus which required daily dressing. The bowels moved naturally without cathartics.

The patient made frequent requests for an operation which would cure the sinus. These were persistently refused, and on her own initiative, without my knowledge, she consulted Dr. John T. Bottomly, who undertook the task, at the Carney Hospital, on March 20, 1909. The patient died three days later of a general peritonitis. There was no post-mortem examination.

CASE 5. Patient of Dr. J. E. Blake, female, age 32, complained of a movable tumor in the abdomen, which she had had for three years. There was a history of a severe constipation for many years, and the loss of weight and strength during the past six months. Physical examination showed a rounded, movable tumor in the abdomen, below the liver, not tender and resembling a grapefruit in shape and size. The urine contained a slight trace of albumin and a few hyaline and granular casts. Physical examination was otherwise negative. Cystoscopy and catheterization of the ureters showed a urine normal in amount and character on the right side and diminished on the left side.

Operation, through the lumbar route, showed a kidney with a translucent, yellowish, thin walled cyst, the size of an orange, originating in the lower pole of the kidney. The cyst was emptied and excised. The bleeding from the cystic area was overcome by overcasting the edges with catgut sutures. The kidney was replaced in its normal position, the wound drained, and the patient made an uneventful recovery (Fig. 4).

CASE 6. Female, age 70, entered the Boston City Hospital, January 16, 1909, with a severe pain in the right upper quadrant of the abdomen, shooting to the right shoulder. There was nausea, vomiting, a high temperature and leucocyte count. The physical examination showed marked tenderness and spasm in the right upper quadrant in the region of the gall-bladder.

Operation, by Dr. F. B. Lund, who found the gall-bladder involved in a mass of acute inflammatory adhesions with an abscess between it and the liver containing about 4 ounces of pus and a gall-stone. The area was drained. The urine before and after operation was normal. The patient developed a facial erysipelas and died February 3, 1909, of sepsis.

Autopsy showed in the left kidney a cyst 5 x 5 centimeters in the upper pole. The content of this cyst was a clear amber fluid. There was no other gross change in the kidney. A microscopical examination of the kidney tissue showed slight chronic interstitial nephritis, and the same in the right kidney.

CASE 7. Male, age 70, entered the Boston City Hospital, May 23, 1904, with symptoms of typical coronary sclerosis. Other than the changes in the circulatory system and a urine of chronic diffuse nephritis, there were no abnormal signs in the physical examination. The patient died May 27, 1904.

Autopsy showed in the left kidney, lower pole, a cyst, the size of an orange and the content a clear yellow fluid. There were no other gross changes in the kidney. The right kidney showed a cyst the size of a large plum, in the upper pole, with no gross changes in the kidney. Microscopical examination showed a moderate, chronic, diffuse nephritis.

CASE 8. Male, age 53, entered Boston City Hospital, July 23, 1906. The case was one of typical lymphatic leukæmia. The only complaint was weakness. The spleen was palpable and the blood changes characteristic; the urine was of low specific gravity, but otherwise normal. The patient died July 26, 1906.

Autopsy showed a cyst, the size of a large lemon, in the upper pole of the right kidney. The content was a dark liquid. Microscopical examination of the renal tissue showed a few areas af lymphocytic infiltration in the capillaries of the pyramids.

CASE 9. Male, age 77, entered the Boston City Hospital March 9, 1896, died of cardiac disease March 22, 1896, without symptoms referable to the urinary system, except that the 24-hour amount of urine was diminished and had the characteristics of a mild interstitial nephritis.

Fig. 3. Case 2. Kidney with cyst in lower pole. Hypernephroma in body of kidney and projecting into renal vein. Nephrectomy.

Autopsy specimen showed a cyst, the size of a fist, in the upper pole of the left kidney. Microscopical examination of the renal tissue showed a chronic interstitial nephritis.

CASE 10. Male, age 56, entered the Boston City Hospital, July 20, 1896, with a severe cardiac disease from which he died in a few days. The physical examination failed to reveal anything in connection with the kidneys, except that the urine was that of a mild interstitial nephritis.

Autopsy showed a cyst, the size of a small orange, in the lower pole of the right kidney. The gross appearance of the kidney was otherwise negative and the microscopical examination showed a mild interstitial nephritis.

Besides the autopsy findings enumerated, there appear 29 instances of solitary cysts of the kidney among the autopsy records of the Boston City Hospital and Long Island Hospital. These cysts are in most instances relatively small, but correspond in every detail of character to the larger ones. In all

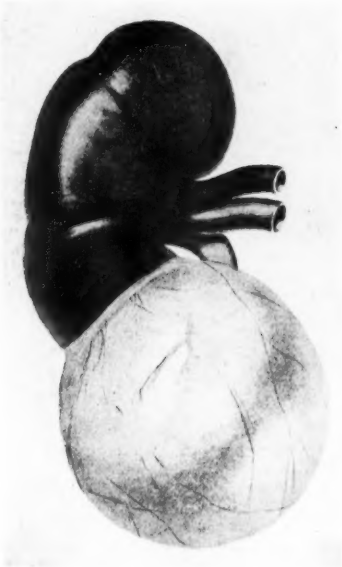

Fig. 4. Case 5. J. B. Blake. Resection of cyst.

but five instances there was found some histological changes in the interstitial tissue of the affected kidney. In the five exceptions, the kidneys were histologically normal.

The list of specimens of the smaller cysts follows:

1. Cyst 2.5 x 3 cm.; left kidney, upper pole; content serous; histology, slight interstitial nephritis.
2. Cyst 3 x 3 cm.; left kidney, upper pole; content serous; histology, slight interstitial nephritis.
3. Cyst 3 x 4 cm.; left kidney, upper pole; content serous; histology, slight interstitial nephritis.
4. Cyst containing 10 ccm.; right, middle, anterior; content serous; histology, slight interstitial nephritis.
5. Cyst 1.5 x 2 cm.; left kidney, upper pole; content serous; histology, slight interstitial nephritis.
6. Cyst 1.6 x 2 cm.; left kidney, upper pole; content serous; histology, slight interstitial nephritis.
7. Cyst 2.6 x 2.5 cm.; left kidney, upper pole; content serous; histology, slight interstitial nephritis.
8. Cyst 4.5 x 4 cm.; right kidney, lower pole; content serous; histology, slight interstitial nephritis.
9. Cyst 3 x 3.5 cm.; right kidney, upper pole; content serous; histology, slight interstitial nephritis.
10. Cyst 1.5 x 1.5 cm.; right kidney, (midanterior, walls calcareous and containing small calculi); histology, slight interstitial nephritis.
11. Cyst 3 x 2.5 cm.; left kidney, lower pole; content serous; histology, slight interstitial nephritis.
12. Cyst 3.5 x 2.5 cm.; left kidney, upper pole; content serous; histology, slight interstitial nephritis.
13. Cyst 3.5 x 2.5 cm.; left kidney, lower pole; content serous; histology, kidney normal.

14. Cyst 4 x 3 cm.; right kidney, upper pole; content serous; histology, kidney normal.

14. Cyst 4 x 3 cm.; left kidney, lower pole; content serous; histology, kidney normal.

15. Cyst 2.5 x 3.5 cm.; right kidney, upper pole; content serous; histology, communicating with pelvis.

16. Cyst 4 x 5 cm.; right kidney, lower pole; calcareous walls and old infarcts.

17. Cyst 2 x 3.2 cm.; right kidney, greater curvature; content serous; histology, moderate interstitial nephritis.

18. Cyst 5 cm.; right kidney, upper pole; content serous; histology, moderate interstitial nephritis.

18. Cyst 50 cc.; left kidney, lower pole; content serous; histology, old infarcts.

19. Cyst 5 cm.; right kidney, upper pole; content serous; histology, slight interstitial nephritis.

20. Cyst 5 cm.; left kidney, upper convex border; content serous; histology, slight interstitial nephritis.

21. Cyst 35 ccm.; right kidney, anterior surface; content serous; histology, slight interstitial nephritis.

22. Cyst 5.5 x 6 cm.; right kidney, upper pole; content serous; histology, slight interstitial nephritis.

23. Cyst size of ½ kidney; left kidney, lower pole; content serous; histology, slight interstitial nephritis.

24. Cyst 7 cm.; right kidney, midanterior; content serous; histology, slight interstitial nephritis.

25. Cyst size of English walnut; right kidney, upper pole; content serous; histology, normal.

26. Cyst size of lemon; right kidney, lower pole; content serous; histology, normal.

27. Cyst 7 x 6.5; left kidney, lower pole; content serous; histology, normal.

28. Cyst size of egg; right kidney, upper pole; content serous; histology, moderate interstitial nephritis.

29. Cyst size of lemon; right kidney, upper pole; content serous; histology, moderate interstitial nephritis.

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CLINICAL DATA OF POLYCYSTIC KIDNEY[1]

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UNTIL recently the clinical diagnosis of polycystic kidney has been regarded extremely difficult and the occurrence of the disease rare. The majority of cases have been discovered at necropsy and reported from the records of large general hospitals. However, with increased knowledge and with the aid of recent methods of clinical examination, the condition is no longer looked upon as infrequent and may be recognized often clinically. This is particularly true in surgical clinics where patients with surgical complications of polycystic kidney seek relief.

According to the records of the Mayo Clinic up to May 1, 1916, 41 patients had been operated on who, on exploration, were found to have polycystic kidneys. Twenty-six of these were recognized clinically.

Occurrence. Kidd divides the course of the disease into 3 stages:

1. The latent stage necessarily occurring in the young adult and usually discovered only in the course of general abdominal exploration.

2. The stage of renal tumor and hæmaturia (usually found in surgical clinics in patients at middle adult life) and

3. The uræmic stage (more commonly seen in the general hospital or medical clinics).

The early age of the majority of the patients in this series emphasizes the fact that polycystic kidney is usually discovered on surgical exploration, in either the stage of latency or the stage of surgical complication. Only cases of the adult type have been included since no case occurring in infancy was observed which could be regarded as surgical. Although the average age was 46 years, 10 patients (25 per cent) were below 40 years of age. One of the 2 who were below 30, was only 18. On the other hand, 7 (17 per cent) were 60 years or more, showing that because of an unusual degree of resistance, the condition may not be recognized until surgical complications cause subjective symptoms. No material difference in occurrence as to sex was noted. In regard to hereditary tendencies, the records are not complete, but definite evidence that heredity has an influence was noted in several instances. In 1 patient a history of cystic kidney was ascertained for two preceding generations.

SUBJECTIVE SYMPTOMS

The predominant subjective symptoms usually are: pain, hæmaturia, tumor, and such symptoms as result from diminished renal function.

Pain. Unless interference with urinary drainage or widespread infection occurs, the pain is not severe in character. Occasionally, however, a dull ache is referred to either loin, usually unilateral, which may be explained as due to an increase in the size of the cysts, which causes either pressure or increase of intrarenal tension. Interference with drainage resulting from blood-clots, lithiasis, and ureteral obstruction may be the cause of severe colic, and mask the underlying condition.

Hæmaturia. Hæmaturia occurred in 16 cases (40 per cent). It was usually profuse and continued over periods of from several days to several months. In 6 cases, it was described as occasional, and in 8 as continued over a period of months. Hæmaturia is evidently caused by rupture of small blood-vessels in cysts, and the blood appears in the urine only when one of the cysts ruptures into the renal pelvis. With a recent history of hæmaturia, large cysts filled with dark bloody fluid, or degenerated blood-clots of various hues may be found on surgical exploration. Hæmaturia is usually stopped by puncture of the blood-distended cysts. The severe colic frequently accompanying the condition is caused as a rule by clots, although over-distention of the cysts may also be a factor. Intracystic hæmorrhage may be present without hæmaturia.

[1] Read before the Association of Genito-Urinary Surgeons, May 11, 1916, Washington, D. C.

Fig. 1. The right pelvis is displaced downward and median. The outline of the true pelvis is irregularly oblong and the calyces largely obliterated.

Evidence of renal insufficiency. The clinical symptoms and data in cases of polycystic kidney in the stages of renal insufficiency may resemble those occurring in interstitial nephritis to such a degree that it has been argued the two conditions are practically identical. When clinical evidence suggests interstitial nephritis in young adults, it is advisable to examine carefully for evidence of bilateral renal enlargement. However, the clinical symptoms of renal insufficiency with polycystic kidney differ in many respects from those occurring with nephritis. In most instances the first evidence of renal disturbance and occasionally the only evidence during a period of several years, is nausea and vomiting. It was present in 6 of the 9 patients showing other clinical evidence of renal insufficiency. Cardiac disease occurred but infrequently, and is evidently a terminal complication. None of the patients had œdema of the extremities.

Blood-pressure. Blood-pressure records were available for but 16 patients; it was normal in 7. In the remaining patients the systolic blood-pressure was variably increased. In 1 case it rose as high as 240, and the diastolic pressure as high as 180. Two of the 4 patients with a systolic pressure of more than 200, died as a result of operation. The question may well be raised whether any operation will materially influence or permanently reduce a very high blood-pressure. In 3 of the patients with high blood-pressure examined subsequent to operation, the blood-pressure was decreased but little. An extremely high systolic and diastolic blood-pressure with a specific gravity as low as 1003 or 1004 and but a trace of phthalein, contraindicates even a Rovsing operation.

Urinary data. The specific gravity in 17 of the 41 cases was 1015 to 1031; in 14 cases, 1010 to 1015; in 9 cases, below 1010.

Low specific gravity and polyuria are to be expected with polycystic kidney in the stage of present or impending renal insufficiency. In other stages it is not necessarily present and a normal specific gravity does not exclude polycystic change. It is of interest that all but 1 of the patients with a specific gravity below 1010 have been reported dead, and these constitute all the deaths so recorded in the entire series. A low specific gravity is, therefore, of considerable prognostic importance.

Phthalein estimate. A phthalein estimate was made for 11 patients. In 5 it was found to be from 40 to 73 per cent, in 2, 30 to 40 per cent, in 2, 29 and 22 per cent respectively, and in 2, only a trace. The 2 latter patients died following operation. A normal phthalein as well as a normal specific gravity is present frequently with polycystic kidney and does not exclude the condition. A trace of phthalein returns in two hours usually excludes a Rovsing operation and warrants nephrectomy only in exceptional conditions. The phthalein excretion and specific gravity were parallel with but few exceptions. In 1 case the specific gravity was 1020 and the phthalein 29 per cent. The phthalein test is of even more value, however, in differential functional estimates in determining which of the two kidneys has the greater functional capacity. It is of interest that a difference of several degrees in functional activity was usually noted in the two polycystic kidneys even when otherwise normal. This coincides with the comparative difference in size and functionating tissue usually found in the kidneys.

Fig. 2. The left pelvis is markedly compressed by multiple cysts so that a narrow streak only remains. The calyces are obliterated and the true pelvis markedly flattened and elongated. Upper and lateral displacement of the kidney is evident. The right pelvis shows abbreviation of the calyces and increase in the size of the true pelvis, thus simulating a moderate degree of hydronephrosis.

Fig. 3. The calyces widely retracted and broadened throughout. Their outline is suggestive of pyonephrosis but the absence of any evidence of infection in the urine excludes inflammatory dilatation.

Microscopic data. In all but 10 of the 41 patients either red blood-cells or white were present in the urinary sediment. In several instances microscopic blood-cells were found where there was no history of gross hæmaturia. However, it is not true, as has been claimed, that red blood-cells are always present. The large number of cases in which there is a small amount of microscopic pus is noteworthy. This may be explained as being due to infection from insufficient drainage from the calyces and pelvis as the result of cystic deformity. Casts were reported present in but 5 cases; they were described as hyaline and occurred only sparingly.

It is noteworthy that the ophthalmoscopic examination was negative in every case.

Tumor. Renal tumor was noted in 31 of the 41 patients. In 3 patients the enlarged kidney was mistaken for tumor of the liver or gall-bladder. In 6 patients the condition was first discovered at operation performed for other abdominal conditions. It may be inferred, therefore, that polycystic kidneys do not cause recognizable renal enlargement on either side. Renal tumor was described as bilateral in but 18 of the 31 tumors palpated, showing that in a large percentage of cases but one kidney is definitely determined to be enlarged on abdominal palpation. Because of this, error in diagnosis is frequently made, the inference being that the condition is unilateral. Particularly is this true when there is a surgical complication in one kidney increasing its size or directing the clinical examination to the affected kidney. It is obvious that a diagnosis of unilateral polycystic kidney based on physical examination and without corroboratory data has no exact value.

Pyelography. As might be expected, the cystic transformation of the tissues about the renal pelvis has considerable influence on its outline. There is recognizable deformity of the pelvic outline in more than 50 per cent of polycystic kidneys (Figs. 1 and 2). The evidence of abnormality is characterized by (1) flattening and obliteration of one or more major calyces, (2) retraction and broadening of the various major calyces, (3) elongation or rounding of the true pelvis, and (4) displacement of the pelvis from its usual position and angle. The retraction of the calyces differs from that occurring with neoplasm in that

Fig. 4. The major calyces are retracted and irregularly broadened at the apices. Some of the minor calyces are retained. This type might be confused with that caused by neoplasm but may be differentiated because of the bilateral deformity.

Fig. 5. Marked irregularity and diffuse enlargement of the calyces is apparent. The breadth of the elongated calyces differentiate it from the narrowed calyces with neoplasm.

they are broadened instead of narrowed as in the latter condition (Figs. 3 and 4). Inflammatory dilatation is differentiated readily by the absence of pus in the urine as well as by the absence of clubbing in the calyx terminals. The possibility of retention of the injected medium because of imperfect urinary drainage which is frequent in polycystic kidney must be remembered. For this reason simultaneous bilateral pyelography should not be employed. Unnecessary ureteral catheterization of the polycystic kidney is also to be guarded against because of the ease of infection resulting from the faulty drainage. As a precautionary measure the injection of a solution of silver nitrate is usually advisable before the ureteral catheter is withdrawn (Fig. 5).

SURGICAL TREATMENT

1. *Nephrectomy, 14 cases.* The various reasons for operation were: (*a*) Tumor with complete cystic degeneration and areas of necrosis in 4 cases; (*b*) lithiasis, unilateral, in 3 cases; (*c*) diffuse infection in 3 cases; (*d*) hæmaturia with complete cystic degeneration, in 2 cases; (*e*) traumatic rupture in 1 case, and (*f*) hydronephrosis in 1 case.

One patient died as the direct result of the operation. Ten of the 13 patients were traced; all were alive except 1 who died of pelvic malignancy three years after the nephrectomy. Of the 10 living, 2 were operated on one year, 2 two years, 2 three years, 3 four years, and 1 ten years ago. The good results following nephrectomy are remarkable and demonstrate very clearly that nephrectomy can be performed if the function of the remaining kidney warrants it. Nephrectomy was indicated in the cases of hæmaturia because of marked cystic change and areas of tissue-necrosis. When there was infection, the process was so widespread that little secreting tissue remained and systemic toxæmia resulted. In one case a moderate degree of infection was found in the other kidney as well, but not enough to interfere markedly with its function. Infection is evidently the result of incomplete urinary drainage resulting from the cystic change. The stones were multiple in two of the cases of lithiasis, and were scattered in various parts of the kidney. They were of the phosphatic type and probably secondary to imperfect urinary drainage.

2. *Exploration for unilateral renal lesion, 5 patients.* Before the value of the Rovsing operation was recognized 2 of these patients

were only explored for unilateral tumor. With the others, either abdominal complication or evidence of renal insufficiency prevented further operation. One patient died two weeks later as the result of the exploration; 2 others died within two years after operation.

3. *Polycystic kidney discovered on surgical exploration in the course of operation for other abdominal diseases, 8 patients.* In this group the disease was in the latest stage and in 5 patients had given no clinical evidence of its existence. In 3 it was masked by other conditions existing in the abdomen and was overlooked clinically.

4. *Rovsing operation.* The Rovsing operation was performed on 10 patients; in 7 the condition was recognized clinically prior to operation. Two patients died as the result of the operation, and 1, three years following. Of the remaining 7 reported alive, 4 were operated on during the past year, 1 two years ago, 1 three years ago, and another five years ago. Four of this number were operated on because of persistent hæmaturia. Recent recurrence of hæmaturia was noted in 1 patient operated on two years ago. Two patients were operated on with a view to improve the renal function which was markedly reduced, 1 of whom died three days after; the other was reported improved one year later. The remainder were operated on because of renal tumor exploration.

As the result of operation the kidney becomes greatly reduced in size, but that it may subsequently increase in size was proved in a patient examined two years after operation. Therefore, punctured cysts may either regenerate, or others so small that they are disregarded at operation may increase in size, although as a rule not to the original extent.

5. *Operation or treatment for other lesions, 4 cases found at post-mortem.* Three of these patients died at the hospital of surgical complications following operation for various abdominal complaints. The cystic disease was not advanced and was evidently in the latent stage since there were no clinical data which might lead one to suspect polycystic kidney. One patient reached the Clinic in a semicomatose condition, dying several days later with uræmic symptoms. The condition was discovered at necropsy.

6. *Patients on whom no operation was performed.* Twenty-one cases were observed in which the clinical diagnosis of bilateral kidney was evident, but because they were not explored surgically and definite proof was lacking, they are not included in this report. Of this number, 11 showed such unmistakable evidence of marked renal insufficiency that operation was not believed advisable. The majority of the group represent the advanced stage of the disease and the diagnostic data necessarily differed markedly from those regarded as surgical. The presence of bilateral cystic tumor, high blood-pressure, low specific gravity and reduced phthalein return, together with a history of gastric disturbance and hæmaturia hardly leave the diagnosis in doubt.

In conclusion it may be stated that when renal function is reduced to the extent that the patient shows marked clinical evidence of chronic toxæmia; when the blood-pressure is increased as high as 200 or more; when the various renal functional tests, such as absence of phthalein return or marked increase in blood urea, show marked renal disturbance; any operation is attended with considerable danger and is of questionable value. When, however, there is evidence of but a moderate degree of renal insufficiency, the Rovsing operation is often followed by considerable benefit. It is particularly indicated in the presence of larger cysts which frequently cause mechanical pressure on the adjacent tissues. The operation is also valuable in checking otherwise uncontrollable hæmaturia, but it does not always have a permanent influence.

Nephrectomy is indicated only in the presence of widespread infection, persistent hæmaturia, and destruction of renal tissue as the result of mechanical obstruction or lithiasis or other complication. It is, of course, possible only after the function of the remaining kidney has been demonstrated to be satisfactory. Functional tests are of particular value when the surgical kidney has caused marked systemic symptoms not easily differentiated from those caused by insuffi-

ciency in the remaining kidney. Whether or not the condition is unilateral in certain rare instances is not of great practical importance, since surgical treatment is feasible as long as the function of one kidney has been demonstrated to be good even if it is polycystic. Whether or not a nephrectomy is permissible may usually be ascertained from the general clinical picture, cystoscopic examination, and the functional test of the opposite kidney.

A STUDY OF EXSTROPHY OF THE BLADDER

With Report of a Case Five Years After Implantation of the Ureters into the Rectum[1]

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EXSTROPHY of the bladder is one of the most distressing afflictions surgeons are called upon to treat. Fortunately it is a relatively rare malformation. Its incidence is given variously from 1 in 100,000 births (1) to 4 in 116,500 births (2). The ratio in which it occurs in boys and girls (3) is 7 to 1.

The embryological explanation, whether it be "rupture of the urogenital part of the cloacal membrane cephaloid to the genital tubercle" (4), "abnormal distention of the allantois and urinary tract" and consequent rupture (5), or failure of the bladder-walls to unite (5), does not concern us here. The present study will discuss the principles involved in successful surgical treatment, and the relative merits of the types of operations which have been suggested.

The long list of measures suggested for exstrophy of the bladder implies at once that no one is adequate. Many types of treatment, and many modifications of these types have been tried. Some of them can be dismissed with mere mention, as obviously failing to serve. There is a preponderance of failures over successes among unreported cases, and hence from published reports is obtained the relative value of methods rather than their absolute worth. Moreover, any one surgeon sees but an occasional case, and rarely is one permitted to compare different modes of treatment in personal experience.

Exstrophy of the bladder may be partial or complete, is always associated with complete epispadias, with partly bifid scrotum and with separation of the pubic bones. The distance between the pubic bones may be as much as 10 centimeters (6). Probably the prostate and seminal vesicles are always present, as are the testicles. The sphincter ani is sometimes weak, and Stefanesco-Galatzi (7) reports a case with absence of this muscle. Urine trickles constantly from the open bladder, which early becomes infected and very tender. The pubic bones are held together by a fibrous band — some deny this as a constant condition (8) — and station and locomotion are satisfactory. The conditions to be dealt with are the tender and suppurating bladder, incontinence of urine with the ever present urinous odor, and the possibility of renal infection.

Control of the last two conditions presents the difficult problem — one intimately associated with the general topic of ascending infections. In 1903, Sampson (9) systematically considered all the possible channels for an ascending urinary infection, and showed the lymphatic system to be the most common one. Referring to the effect of injury to the ureteral orifice, he recognized that "something additional is usually necessary" for an ascending infection. Draper and Braash (10) concluded tentatively that in the human subject ureteral meatotomy alone was harmless; but Barber and Draper (11) in experimental work found the normal ureteral orifice an important factor in preventing the passage of infection from the bladder to the kidneys in dogs, in which the blood and nerve supply of the ureter had been destroyed. Also, Sampson concluded

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that in human beings ascending infection was found only with disease or injury of the ureteral orifice. More recently, Sweet and Stewart (12), by a series of ingenious experiments involving anastomosis of the ureters with the bowel of dogs, proved in a convincing manner that the lymphatics are the route traveled by an ascending renal infection. They support this conclusion on the clinical side by quoting Sugimura's observation in 21 autopsies that the walls of the lower part of the ureters are nearly always involved in acute cystitis, with only a little inflammation in the mucosa. In this discussion we have had in mind the paths by which bacteria, which may reach the kidney, leave the bladder. It is possible, anatomically, that organisms once in the lymphatics may reach the kidney without entering the general blood stream, but the work of Crabtree (52) indicates that bacteria from the bladder travel in the finer lymphatics, the thoracic duct, then the blood stream, en route to the kidney.

Ascending infection by growth of bacteria along the ureteral mucosa is hardly supported by facts. Ascending infection through the lumen of the ureter is today considered rare, if not impossible, without the presence of obstruction to the flow of urine from the kidneys. Renal infection may be dependent upon inflammation about the ureteral orifice, but this lesion has opened up the lymphatic paths. Ascending infection through the veins alone, except by advancing thrombosis, seems very improbable.

Mention should be made of Stewart's observations in experimental work on dogs; first (13), that renal infection following uretero-intestinal anastomosis depends somewhat upon the apparently increased virulence of the intestinal flora growing in ulcerations at the point of anastomosis; and second (12), that the level of the gut at which the ureter is implanted has little effect on the probability of subsequent renal inflammation.

Summarizing, to reduce to a minimum the possibility of infection of the kidneys following ureteral transplantation, one should avoid (a) ureteral obstruction from twist, kink, or constriction; (b) injury to the ureteral orifice; and (c) injury to the blood-vessels and nerves in the wall and adventitia of the ureter. A pre-operative treatment with an autogenous colon bacilli vaccine might be beneficial. This was suggested by Oppel (14), who noted in 19 cases of exclusion of the bladder by implantation of the ureters in the bowel a less severe postoperative pyelitis in patients having a bladder infection than in those with clean bladders, due presumably to a better tolerance of that infection.

What is the prognosis of a case of exstrophy of the bladder if not operated upon? His life is an existence of wretchedness, of abashment and pain. He is offensive to his friends and burdensome to his family, an outcast from society, socially and economically. For few such individuals have the ingenuity and patience to properly care for a urine receptacle and their bodies and clothes and thus maintain an atmospheric environment acceptable to their associates. Marion (3) states that 90 per cent die at birth or in early childhood, but according to Vigneau and Berger (cited by Barras (15) and Buchanan (2)) about 56 per cent die under 10 years of age; and only about two-thirds of those surviving, or 30 per cent of the whole, pass the twentieth year. In a very large proportion of deaths, the cause has been ascending urinary infection. This proneness to pyonephrosis is to be borne in mind when considering operation in a given case. In some instances of deaths following an operative procedure an old inflammation of the kidneys has been found. Bérard and Cotte (16) and Vulliet (17) have had such experiences. Woolsey (18) encountered calculi in both ureters. Hence, examinations by ureteral catheterization, renal function tests, and radiography should antedate operation.

The older methods of operation have been often reviewed. They require no description here.

Numerous autoplastic procedures have been devised to cover in the bladder and to construct a new urethra. If skin is used to make the anterior wall, calculi and phosphatic incrustations are likely to form and will cause great pain. Only those methods utilizing mucous membrane should be used. Complete closure is difficult to obtain, and pa-

tients are often submitted to a series of operations to accomplish this result. It can be said in criticism of all these plastics, that they provide no sphincter to control the urinary flow. Although, according to Mayo (19), Goebel has successfully constructed a sphincter of the pyramidalis muscles. The penis is apt to be drawn up too high for functional use, or in the female vulvovaginal adhesions may form. On the other hand, these plastic operations often relieve pain for a while and provide a better means of collecting urine in a receptacle. The literature shows that a number of patients thus operated upon have subsequently applied for relief from calcareous incrustations or from incontinence. In addition to and as an aid in plastic work on the bladder, apposition of the pubic bones has been employed. The chief types of procedure are represented by Trendelenburg who cuts the sacro-iliac ligaments, and by Albarran who cuts the horizontal pubic and the ischiopubic rami. The advantages of these bone operations are slight and do not warrant the risk involved. A partial continence has been secured (20) in 13 per cent of cases operated upon by Trendelenburg's method, due presumably to a mechanical result obtained by contact of the bladder-walls. Later observations on some of the Trendelenburg cases had demonstrated a re-separation of the pubic bones.

Diakonow (21) has by blunt dissection formed a sinus extending from the bladder, through the perineum, between the sphincter ani and the rectal mucosa, to the skin at the anal margin. This is lined by a strip of bladder mucosa and forms a new urethra controlled by the sphincter ani. The bladder is closed at a later operation. Subbotin is given credit for suggesting such a canal, but made no effort to line it with epithelium. Lerda (22) proposed a similar method, using a skin flap and Thiersch grafts to line the new canal. These procedures have obvious possibilities, but are relatively new, and judgment at this time would have to depend more on speculation than on reported facts.

Both implantation of the ureters on the skin or in the vagina, and nephrostomy relieve the patient of bladder pain, make easier the wearing of a urinal, and are safer as regards kidney infection than uretero-intestinal anastomosis, nephrostomy, etc. Nephrostomy is compatible with many years of life. But these devices fail to obviate the most aggravating of all the patient's symptoms, incontinence.

Incontinence and the other symptoms as well are adequately cared for by shunting the urinary stream into the bowel. But the risk of infection of the kidneys is increased. The surgical problem is how to reduce this to a minimum.

Implantation of the ureters, cut across above the bladder-wall, into the intestinal tract has been employed in many cases of exstrophy and other bladder conditions. We have come across 13 methods (48, etc.) involving this principle. Some form a new bladder of a loop of bowel, which is made to communicate with the skin or with the bowel. In the latter case, the object is to prevent the passage of fæces across the ureteral openings. Other methods make a direct implantation into the bowel carrying the fæcal current. Of this group, we will mention two: First, the well-known Coffey (23) operation, which when carefully and properly performed, promises well. C. H. Mayo (19) reported four exstrophy cases so treated without operative mortality. We found no late reports of such operations. Second, implantation of the ureters in the sigmoid with the embedding of 3 centimeters or more of each ureter in the wall of the sigmoid (similar to the technique used in a Witzel gastrostomy) has been tried a number of times. Brewer (24) and J. A. Johnston (25) each report a case so treated which has remained well after 3 years.

Cuneo (26) isolates a loop of ileum, preserving its mesentery, and anastomoses the bowel above with that below the loop. The ureters are transplanted into this loop, and one end of the loop brought out between the sphincter ani and the rectal mucosa. Five recent cases have been reported (26 and 27) with one operative death. Heitz-Boyer and Hovelacque (26) cut across the rectum, leaving the superior hæmorrhoidal artery in the lower bowel. The proximal end of gut is brought to the skin, passing within the sphincter ani but without the rectal mucosa;

and the upper end of rectum is closed by suture. Later, the ureters are separately placed in the isolated rectum which becomes a newly-formed bladder. Three cases have been reported (26, 28, and 17) with one operative death; one case (26) was living and voiding every 2 hours, 18 months after operation. Lastaria (29) modifies this method by stripping muscle and serosa from that part of the bowel placed between sphincter ani and rectal mucosa, to reduce the volume and avoid overstretching the muscle. Makkas (30) and Verhoogen (26) have isolated the cæcum, done an appendicostomy, and implanted the ureters into the cæcum. A catheter was worn in the appendix, and urine drawn off at stated intervals. Reports of these novel methods are too few and too recent to fix the value of them. We believe these cavities will always be infected, and do not expect the results of these methods will warrant the risk of such extensive operations.

At least 9 methods (49, etc.) and modifications of uretero-intestinal anastomosis aim to preserve the ureteral orifices intact. Most of these are not supported by enough clinical data and do not possess sufficient novelty of principle to justify consideration. Soubottini (31) formed of the anterior rectal wall a channel which was joined to the bladder above and controlled by the sphincter ani below. The edges of the remainder of the rectal wall were sutured, and this tube continued to serve as rectum. It was of course still controlled by its sphincter. The operative mortality is 25 per cent, and a technical failure means disaster, loss of control of both urine and fæces. Maydl's operation and that of Bergenhem stand pre-eminent as the procedures of choice among all the ureterorectal anastomoses used for the relief of the symptoms of exstrophy of the bladder. They relieve the pain and practically always give urinary control.

From Buchanan's excellent summary (2) of reports *published* to 1909, we obtain the following data concerning Maydl's method (32), which is a direct intraperitoneal implantation of the trigone, including both ureteral orifices, in the wall of the rectum. Moynihan (33) did the operation extraperitoneally in one successful case. The immediate mortality is 28.7 per cent. Of 57 recoveries, 65 per cent have lived one year and 24 per cent over 5 years. If we add to Buchanan's list of Maydl's operation the 16 cases cited below, published since 1909 and not included in his article, the immediate mortality becomes 28.1 per cent. Of 69 recoveries from operation, 66.7 per cent have lived over 1 year and 26.1 per cent over 5 years. These figures are practically the same as those taken from Buchanan's article. Bergenhem's operation (34) consists essentially of the independent extraperitoneal implantation of the ureters, each with a rosette of bladder-wall, into the rectum, with removal of the bladder. It is known also as Pozza's (35) operation, and as Peters' (36) operation. On adding to Buchanan's list the seven cases cited below, published since 1909 and not included in his article, the immediate mortality for the Bergenhem operation is changed from 11.5 per cent (Buchanan's figure) to 15 per cent. Of 28 recoveries from operation, 60.7 per cent have lived over 1 year and 21.4 per cent over 5 years; practically the same proportions as those given by Buchanan.

On comparing the two operations, the striking facts are the higher primary mortality of the Maydl operation, the peritoneal invasion and risks involved, and its greater complexity and difficulty. The Bergenhem operation is extraperitoneal and simpler. After recovery from operation, the outlook is about the same. Both procedures presume careful dissection of the ureters with the minimum of trauma to their walls and adjacent tissues in order to protect the nerve and blood supply therein. Both aim at preservation of the ureteral orifice. Both lose the blood and nerve supply reaching the ureters from the bladder. This study has confirmed us in the belief held five years ago, the time of operation on our case, reported below, that the Bergenhem operation offers the best future for a patient afflicted with exstrophy of the bladder.

In doing the Bergenhem operation, one should carefully avoid injury to the ureter and its adventitia and should avoid kinks, twists, and tension. The sphincter ani should not be dilated for fear of permanent injury;

in some patients this muscle is abnormally weak. A tube is left in the rectum a week or more to drain off the accumulating urine. Buchanan's suggestion to hold the rosette of bladder-wall to the skin margin by a suture seems sound. An intestinal suture is unnecessary, and may do harm by constricting the ureter as it passes through the wall of the rectum. To prevent this possibility, several authors have advised that a ureteral catheter be left in each ureter a few days after operation. But this involves additional risk and seems unnecessary. If anuria occurs, inspection of the ureters and ureterorectal junctions should be unhesitatingly made. Oppel (14) encountered anuria in a case in which a procedure similar to a Witzel gastrostomy had been done. Sixty hours after the first operation, he intervened, found the ureters dilated with urine, severed the ureters above the anastomosis, and at once reinserted them less snugly, higher in the sigmoid, by a technique identical with that first employed, with a successful result.

The following sixteen cases of Maydl operation, which have been published since Buchanan's report, will be noted very briefly.

1. Case of Guinard (20). Patient with one kidney well after 8 years.
2. Case of Erdman (24) mentioned in discussion; died twelfth day of pneumonia.
3. Case of Broca (20) died of ascending infection.
4. Case of Broca (20) died of ascending infection.
5. Case of Panchet (20), operative death.
6. Case of Panchet (20). Death from ascending infection, 12 months after operation.
7. Case of Panchet (20). Death from ascending infection, 14 months after operation.
8. Case of Panchet (20). Death from ascending infection, 15 months after operation.
9. Case of Ewald (37). (Not in Buchanan's summary.) Boy, age 4 years, well after 12 years.
10. Case of Ewald (37). (Not in Buchanan's summary.) Boy, age 18 months, well after 8½ years.
11. Case of Graser (38). Girl, 4½ years, well after 5 years.
12. Case of Graser (38). Boy, 7½ years, well after 1 year.
13. Case of Robineau (39). Girl, 7 years, had had good plastic operation; occasional attacks of supposed renal infection followed Maydl operation.
14. Case of Van Sweringen (40). Boy, age 13 years, well after 9 months.
15. Case of Whitacre (41). Woman, age 21 years, well after 1 year and 7 months.
16. Case of Woolsey (18). Boy, age 3 years, removed 2 stones from right ureter and 5 from left ureter at time of the Maydl operation; well after 8 months.

The following six cases of Bergenhem operation have been published since Buchanan's report.

1. Case of Augier (42). Boy, age 17 years, died 40 hours after operation. Autopsy performed; cause of death not known; had passed urine from the bowel.
2. Case of Arumugan (43). Boy, age 10 years, well 5 weeks after operation.
3. Case of Ball (44). Boy, 5 years, well 9 months after operation.
4. Case of Feutrie (1). Died of "uræmia" 24 hours after operation. Cause of death not clear from description.
5. Case of Simpson (45). Girl, age 8 years. Operator carried the ureters through the vagina, then placed them in rectum; well 18 months after operation.
6. Case of A. Thompson (46). Boy, age 9 years, died 2 years and 3 months after operation with convulsions, dropsy, and fever.

AUTHOR'S CASE

A Jewish boy, age 16, undersized, was first seen by us in February, 1911. He had had three unsuccessful attempts made to close the exstrophied bladder at two years of age. His general health was fair. In the suprapubic region, there was an inflamed exposed area of bladder mucosa 4 centimeters in diameter, the upper and lateral borders of which consisted of scars from the earlier operations. There was complete epispadias, partly bifid scrotum, and a 4 centimeter separation of the pubic bones determined by palpation under an anæsthetic. The roentgenpgraphs indicated a separation of 10 centimeters — a discrepancy noted before (51), and due to incomplete ossification or to faulty technique in radiography. The recti muscles were widely separated. The exposed bladder was exquisitely tender and was intermittently flooded with urine. It was partly hidden from view by the upturned, flattened penis. The testicles and spermatic cords were normal. The prostate was of usual size but twice as wide laterally as in the anteroposterior diameter. Small, slightly distended seminal vesicles were palpated, extending up from the lateral borders of the prostate. Normal prostatic fluid was expressed from the open urethra by massage of the prostate, and a few inactive spermatozoa were found. A small right inguinal hernia was present, and marked bulging over the left external ring.

Urine caught as it dripped from the bladder was clear and contained only a few leucocytes, but myriads of bacilli and micrococci. A phthalein test was done, the color appeared in 9 minutes, and 36 per cent was recovered in the first hour, although

considerable urine was lost. Under a general anæsthetic, a bladder large enough to hold a small hen's egg was found. There were neither calculi nor incrustations, but many small papillary excrescences were noted, scattered over the bladder mucosa. The verumontanum was present and appeared to be normal. The ureters were easily found, functioned normally, and admitted catheters easily. The urine obtained from the ureters showed neither pus nor bacteria microscopically.

Operation was performed April 6, 1911, under gas and ether anæsthesia. Catheters were placed in both ureters. A rosette of bladder-wall, including the muscle, was dissected free about each ureteral orifice. The ureters were freed high enough so that they could assume the straightest course from the brim of the pelvis to the rectum. The left ureter was accidentally broken into early in the operation, and the rent promptly sutured. A curved artery forceps was introduced in the rectum. On the tip of this, a small opening was made in the left anterolateral rectal wall, 2 or 3 centimeters above the internal sphincter. The forceps were made to protrude, to grasp the edge of bladder-wall about the left ureteral orifice after the catheters had been removed, and to withdraw the ureter well into the rectal lumen. Similarly, the right ureter was placed in the rectum. No suture was taken in the rectal wall. What would come away easily of the bladder-wall was removed.

A tube was kept in the rectum the first four days after operation, and the rectum irrigated several times a day. Urotropin was given before operation and for many weeks afterward. The temperature ranged between 100° and 102° for ten days. On the fifth day there was pain and distinct tenderness of the left kidney. These entirely disappeared in 48 hours. Similar attacks (always in the left kidney) recurred twice in the following two months, but never subsequently. There was considerable odorless oozing from the wound for ten days, then a definite urinary leakage. This urinary fistula was completely healed four weeks after operation.

Because of the tenderness of the exposed mucous membrane, a second operation was performed on May 18. The mucosa on the penis and the more exposed bladder membrane were excised. The deeper part of the latter was not removed, because it was very adherent from previous operations, very vascular, and not exposed to trauma.

The patient was discharged from the hospital June 15, voiding at intervals of 2 to 6 hours. For some months there was frequently nocturnal incontinence. The control in this particular has gradually improved so that now there is wetting of the bed only about once a week and then but a small spot. The patient voids urine, often quite free from fæces, every 3 to 5 hours and sometimes goes 7 hours. He gets up at night once or not at all. By measure, a single voiding is often over 350 cubic centimeters. The bowels move usually twice a day, and the patient can often distinguish in anticipation between a passage of urine and one largely fæces. Occasionally a laxative is needed. Erections and frequent seminal emissions have been annoying the past three years. Papillæ nearly 1 centimeter high are formed by the ureteral projections in the rectal lumen and can be readily palpated 2 to 3 centimeters above the internal sphincter ani. Efforts to collect urine directly from the ureters through an endoscopic tube inserted through a proctoscope have not been satisfactory. The voided urine is slightly cloudy, and the sediment from a centrifugalized specimen contains only a moderate number of scattered pus-cells. Of 6 milligrams of phenolsulphonephthalein given intramuscularly, about 25 per cent was recovered from the rectum in 2 hours and 10 minutes. The patient is at work, is in perfect health, and is changed from a wretched, dejected, lonely boy to a bright and happy lad with a real interest in life.

We wish in conclusion to emphasize the wisdom of a careful preliminary examination of the condition of the kidneys before any operation is undertaken on a case of exstrophy of the bladder. Without records of the late history of many patients, it will be impossible to compare the term of life following various procedures with the reasonable expectation of life without any operation. But with our present knowledge, from the humanitarian, the social, and the economic viewpoints, operation in exstrophy of the bladder is clearly indicated if there be no severe renal infection. Methods which effect no control of the urine offer but little comfort to the patient. The simpler procedures that do provide a sphincter are to be preferred. The newer methods which form an extra-intestinal, perineal channel, lined with epithelium and controlled by the sphincter ani, have not been sufficiently tested clinically. We believe that uretero-intestinal anastomoses offer the exstrophy patients the best outlook at the present time. The subject is intimately associated with bladder exclusion for other ailments, and the problem of control of ascending infection is deserving of all the experimental and clinical work being done.

Inasmuch as many of the successful cases have given clinical evidence of temporary renal infection in the first few days following operation, it would probably be safer to transplant the ureters one at a time with an interval of several weeks between operations.

For exstrophy of the bladder, Bergenhem's

operation appeals to us as the best. It seems well established clinically and experimentally that preservation of the ureteral orifice is worth while, whether it acts as a valve or sphincter or whether its preservation merely offers a more circuitous and less likely route for ascending infection to follow in order to reach the ureteral lymphatics. Possibly future observations will indicate that preservation of the ureteral orifice should be combined with embedding the ureter within the bowel-wall.

Finally, while we have found a report of no case of double uretero-intestinal transplantation living over 5 years after any operations other than those which retain the ureterovesical orifice, there are at least 27 such (including the author's case) following the Maydl and Bergenhem methods and their modifications, and one (case of Roux, 47) is well 17 years after a Maydl operation.

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CYSTOGRAPHY

Its Value and Limitations in Surgery of the Bladder[1]

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ALTHOUGH cystography can be more easily carried out than pyelography, nevertheless it is interesting to note that cystography has not received as much detailed study as has pyelography, so that its possibilities and limitations have not been determined as definitely as they have been for pyelography. One of the reasons that cystography has lagged behind pyelography is that cystoscopic examination usually gives the desired information regarding intravesical lesions without resorting to cystography, except perhaps in a certain small percentage of cases, whereas pyelography is sometimes necessary to supplement the knowledge gained from cystoscopy and ureteral catheterization.

In carrying out this work, we used cargentos in 20 per cent solution, emulsion of silver iodide, and a 10 per cent solution of thorium nitrate. Except in the earlier cases, thorium nitrate was used as a routine. The cargentos has given us extremely satisfactory pictures without any signs of irritation or pain; the only objection to its use being its staining properties. The patients in whom the silver iodide was used complained of severe pain and a great deal of vesical tenesmus. In some instances several cystographs were taken at intervals, and each time the patients complained of pain and irritation in the bladder. The thorium nitrate was made up for us according to the formula of Burns of the Johns Hopkins Hospital, by Mr. Gray, Pharmacist of the Presbyterian Hospital.

The normal bladder in adults has been carefully studied by this method so that our knowledge of a normal cystograph is fairly well established.

This method has contributed very largely toward settling the dispute as to the part played by the vesical neck in bladder closure. For many years the question as to the role played by the posterior urethra and vesical neck in bladder closure has aroused considerable interest in the various schools of genito-urinary surgeons. The studies on this topic have resulted in practically an unanimous opinion that the internal sphincter causes vesical closure and that no funnel or neck of the bladder is formed by the posterior urethra. Attempts to prove that the posterior urethra takes part in forming the vesical neck when the bladder is much distended, were made by Oppenheim and Loew and their experiences published. Their findings, however, have not been corroborated by other workers as far as I know. The illustrations presented by them would lead one to infer that they were dealing with pear shaped bladders. They carried out this work in *monkeys*.

The normal cases in my series *did not* show this phenomenon. There was always a very sharp demarcation at the vesical neck, even in the cases in which there was a good deal of straining and in which the urethra was filled with the thorium solution.

The contention that the posterior urethra does not take part in forming a vesical neck was strongly championed for many years by von Zeissl, of Vienna. He set about to demonstrate his views graphically. To accomplish this he introduced mercury into the bladders of two cadavers, and then filled the bladder with a fluid impermeable to the roentgen rays. From his roentgenograms he comes to the conclusion that the posterior urethra does not form the bladder neck. One of his reproductions shows the sharp demarcation between the urethra and bladder. These experiments, although carried out in cadavers, were the first cystographs taken, and were published in 1902.

In Fig. 1 a resemblance to a vesical neck is seen. This was a pathological case, the patient, age 16, suffering with an infection in the

[1] Read at the meeting of the American Association of Genito-Urinary Surgeons, Washington, May 9 and 10, 1916.

space of Retzius, which was opened and drained. The funnel-shaped neck shows irregular margins. Unfortunately, a second roentgenogram was not made. In view of the pathology it would have been interesting to have taken a second picture after voiding, to determine whether this shadow disappeared, or whether it persisted, due to the presence of fluid outside of the posterior urethra.

THE BLADDER IN CHILDREN

To demonstrate any possible differences that may exist between the bladders of infants and adults as far as the shape of the bladder is concerned, a series of roentgenograms of the bladders of children was made. In none of these roentgenograms were we able to demonstrate any different condition in the vesical neck, as far as an encroachment of the urethra on to the bladder was concerned, than is seen in adults. The ten cases studied were free from disease of the urinary organs, and they were patients that had been admitted to the Children's Memorial Hospital for diseases other than urinary. Of the ten bladders, six were distinctly pyriform with the apex situated at the vesical neck and the base of the pyramid above (Fig. 2). Of these six pyriform bladders, three were in boys and three in girls. The ages of the children varied from three to ten years. There was no difference in the shape of these bladders in the girls and boys.

In three the bladders were oval from right to left. One case had a bladder of unusual shape in that the top was concave (Fig. 3). One would be inclined to explain this defect of distention, as being due to some intra-abdominal cause —(bowel?) or perhaps it may have been due to insufficient distention.

REGURGITATION OF FLUID INTO THE URETER

Normally the ureterovesical junction or valve is supposed to prevent a reflux of fluid from the bladder up the ureter and into the kidney. Failure of this mechanism is of serious moment, especially in cases in which the bladder is the seat of infection, inasmuch as infection may be directly transmitted upward into the higher urinary tract.

While I believe that this method of renal infection is not the only possible route of infection, I do believe that infection does not occur nearly as frequently in this way as was formerly taught. Modern views favor the lymphatic origin of renal infection and the urogenic route is being more and more tabooed. Yet it is significant that in ten normal children this phenomenon occurred three times. The accompanying roentgenograms of these normal cases, as well as the pathological cases, demonstrate that this mode of infection is possible.

For purposes of study, the cases in which reflux occurred have been placed into two groups, normal and pathological.

In children this phenomenon occurred four times in eleven cases examined; three times in infants in whom the urinary tract was normal, and once in an infant suffering from colon cystitis and pyelitis (Fig. 4). All of the cases were examined in the same way and under the same conditions. It is rather striking, therefore, to see the frequency with which it was possible to demonstrate regurgitation of fluid into the ureter in children. As far as I know, this is the first time that regurgitation of fluid into the ureter has been demonstrated in children with normal bladders. In these cases examinations were carried out under ether anæsthesia. In each of the four cases the regurgitation was unilateral.

In one of the adults in whom this regurgitation occurred the bladder was perfectly normal, and the ureteral orifices appeared normal upon cystoscopic examination (Fig. 5). During the roentgen examination, the patient had a great desire to urinate, so that he strained a good deal. The roentgenogram shows regurgitation on the left side. Just why this occurred only on the left side is difficult to explain. It would seem logical to explain regurgitation in this case as being due to increased intravesical pressure incident to the straining. A subsequent cystograph made without straining, showed a normal bladder without regurgitation.

In five adult cases in which regurgitation occurred there were associated lesions of the urinary bladder. The following diagnoses were made:

1. Benign hypertrophy of the prostate (Fig. 6).

2. Contracture of the vesical neck (Fig. 7).

3. Tuberculosis of the bladder, prostate, and vesicles (Fig. 8).

4. Tumor of the bladder, chronic retention.

5. In fifth case no definite diagnosis made. In the first three cases cystoscopic examination showed normal appearing ureters. In two cases the ureters were dilated, as revealed by cystoscopic examination. In the three cases in which the ureters appeared normal, there occurred during examination a great deal of tenesmus and straining, so that it became necessary to compress the urethra between the fingers to retain the fluid in the bladder, so that the roentgenogram could be obtained.

The cystoscopic examination does not always give information relative to whether the ureter is dilated or not. The ureter at operation or autopsy may be found very much dilated, although previous cystoscopic examination revealed a normal ureteral orifice. This is precisely what occurred in some of these cases, cystoscopic examination revealing a normal ureteral orifice, and cystography demonstrating that the ureterovesical valve was insufficient and the ureter dilated.

In the two cases in which the ureters appeared dilated there was no apparent increased intravesical pressure, and both had atonic bladders. In this connection it is significant that there were a great many cases in which there was an increased intravesical pressure, yet no regurgitation took place. It would seem that the increased intravesical pressure may be at least partly responsible, in some of the cases, for the occurrence of this phenomenon.

Zuckerkandl noted this occurrence in some of his prostatic cases. I do not recall, however, of having seen reports of its occurrence in normal bladders with normal ureteral openings, nor are cases reported of the occurrence of this phenomena in children with normal urinary organs.

DISPLACEMENTS OF THE BLADDER

Complete displacement of the entire bladder is not possible because of the fixed position of the trigone. That the movable part of the bladder may be displaced as a whole, is quite possible, and this occurred in two patients. In one patient the entire bladder appears displaced to the right (Fig. 5). Close examination shows the urethra filled with fluid. One week after this roentgenogram was obtained, a second cystograph was made, which gave a normal picture. Curiously enough this patient is one of the cases in which there was a regurgitation of fluid into the ureter. This patient was cystoscoped, and the bladder and ureteral orifices appeared normal.

In case two (age 16, Fig. 1) a diagnosis of infection in the space of Retzius, had been made, which I verified by operation. The patient had a slight amount of difficulty in micturition and the urine was negative. As a result of the pus infection outside of the bladder, the entire bladder appears to be displaced to one side, while still retaining almost completely its normal outline.

CHANGE IN THE SHAPE OF THE BLADDER DUE TO PELVIC INFECTION

That the presence of pus in the pelvis may interfere with the complete filling of the bladder, so that its outline presents deviations from the normal, is seen in Fig. 9. This patient suffered from urethral stricture for many years. Upon examination a large pelvic abscess could easily be demonstrated by bimanual palpation with one finger in the rectum. The cystograph revealed a filling defect on the right side, so that it presented a distinctly pathological outline. The margin is very irregular. This irregularity, I believe, is due to the presence of small sacculations, which doubtless, are due to his urethral strictures. In one or two places the sacculations are quite large. Somewhat similar sacculations of the margin were noted in a case of bladder disturbance due to tabes.

FILLING DEFECTS DUE TO ASSOCIATED LESIONS OF THE PELVIC ORGANS IN WOMEN

Filling defects in the bladder may be due to a variety of causes: first, lesions outside of the bladder preventing a complete filling, so that the normal outline of the bladder is not ob-

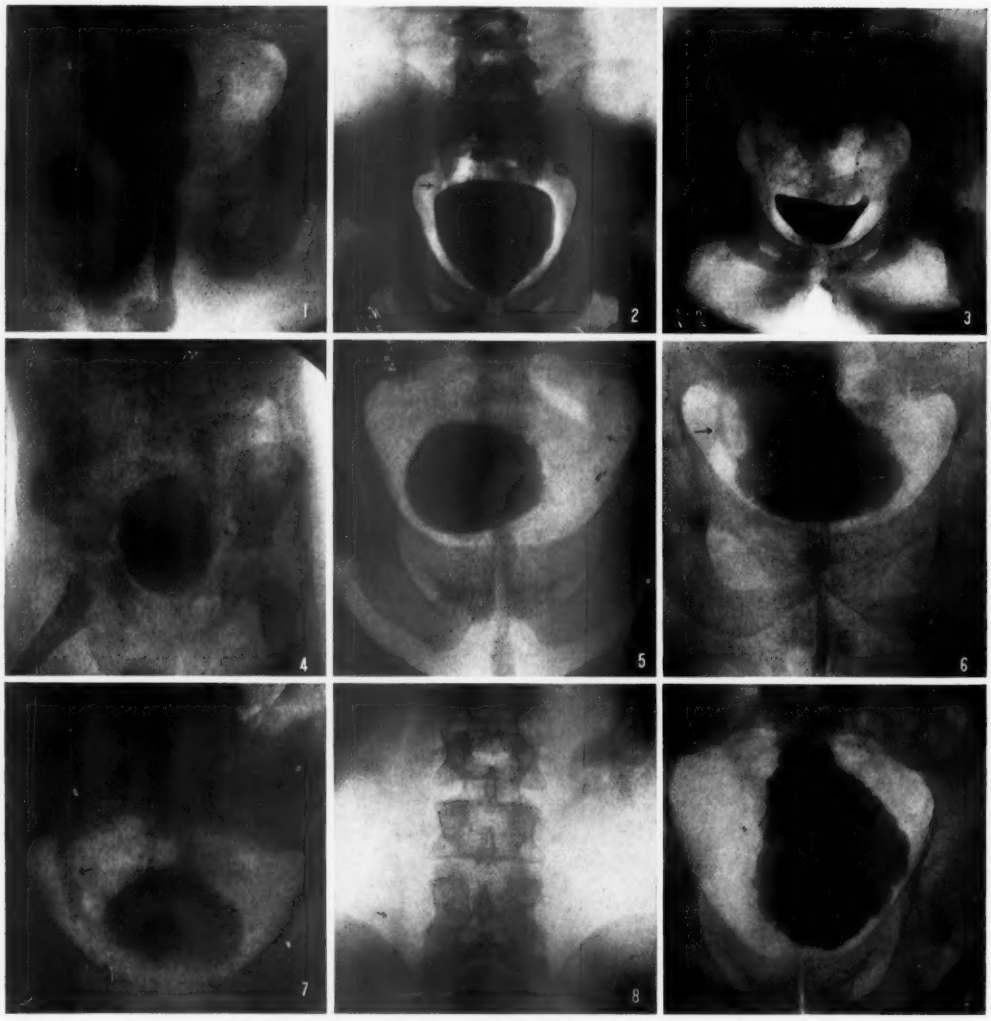

Fig. 1 (at upper left). Complete displacement of entire bladder due to infection in the space of Retzius. Note the neck of the bladder and filled urethra.

Fig. 2. Pyriform bladder. Note the regurgitation of fluid into ureter (see arrow).

Fig. 3. Note peculiar shape of bladder, also regurgitation of the silver iodide into the ureter (see arrow).

Fig. 4. Oval bladder. Note regurgitation of fluid up the ureter and into the renal pelvis (see arrows).

Fig. 5. Regurgitation of fluid into the left ureter, in normal bladder. Displacement of bladder to right. Sharp demarcation between urethra and vesical neck.

Fig. 6. Benign hypertrophy of prostate. Regurgitation of fluid into the left ureter. Note dumb-bell shaped bladder.

Fig. 7. Contracture of vesical neck. Regurgitation of fluid into ureter (see arrows).

Fig. 8. Tuberculosis of kidney and bladder. Regurgitation of fluid into *both* kidneys.

Fig. 9. Interference with complete distention of the bladder due to a pelvic abscess.

tained; second, lesions of the bladder-wall — these may be limited to a part of the bladder-wall, such as that seen in tumors — so that an incomplete filling results; third, filling defects may be due to insufficient filling of the bladder. Great care must be exercised in

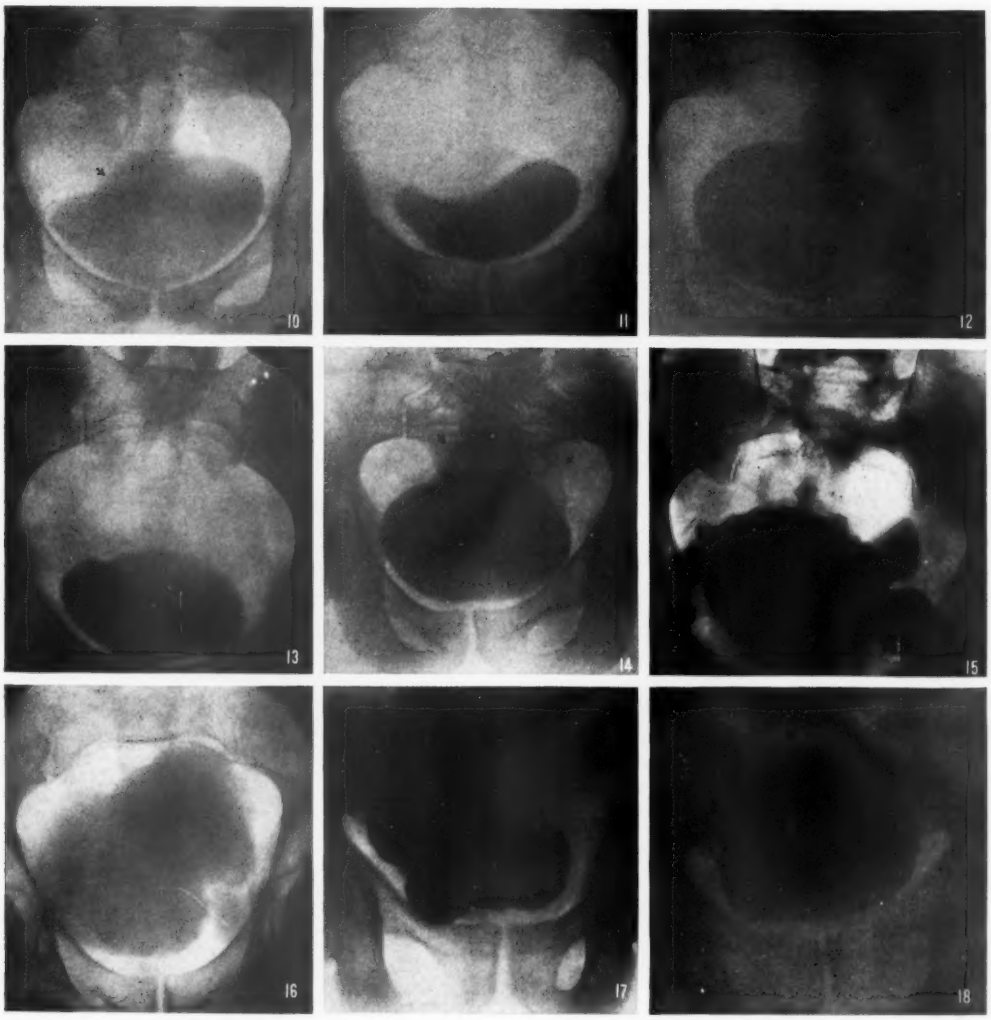

Fig. 10 (at upper left). Filling defect due to pressure from without. Parametritis. Note also double shadow above.

Fig. 11. Filling defect of bladder due to pressure from without. Fibroid of uterus.

Fig. 12. Filling defect caused by enormous carcinoma of uterus.

Fig. 13. Cystoscopy showed a normal bladder. Note darker part of bladder in the right half and light area to left.

Fig. 14. Note accessory shadow at apex of bladder.

Fig. 15. Prostatic hypertrophy. Note absence of broad base. Diverticula of the bladder.

Fig. 16. Extensive diverticula.

Fig. 17. Diverticula of the bladder. Contracture of the vesical neck (?).

Fig. 18. Prostatic hypertrophy showing broad base.

interpreting these filling defects, because of the variety of causes that may produce them. That wrong conclusions and necessarily wrong diagnoses must ensue if each filling defect is to be ascribed to lesions within the bladder or bladder-wall, is obvious, and is illustrated by the filling defects obtained in this series of gynecological cases.

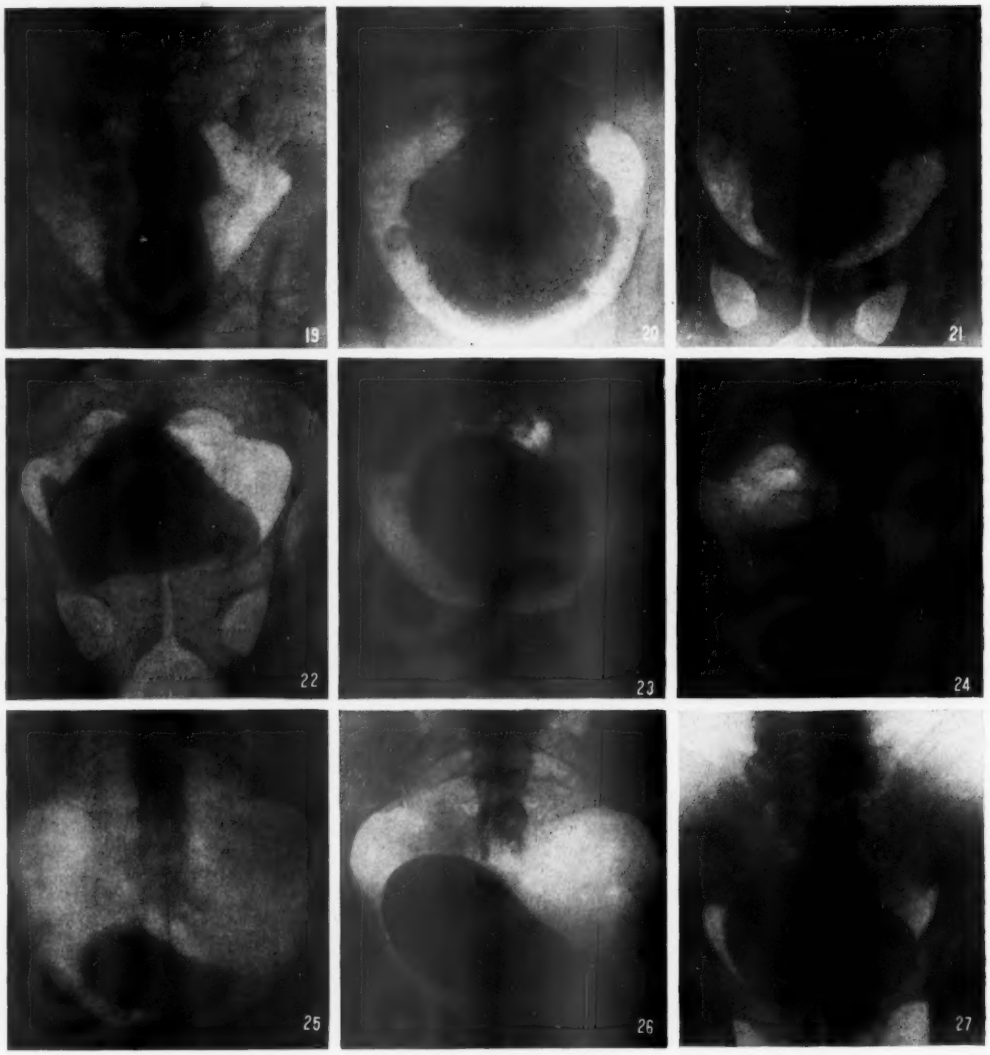

Fig. 19 (at upper left). Benign hypertrophy of prostate. Small contracted hour glass (?) bladder.
Fig. 20. Benign hypertrophy of prostate. Absence of broad base usually found in benign hypertrophy.
Fig. 21. Small fibrous prostate, causing complete retention. Elongated bladder. No broadening of base.
Fig. 22. Carcinoma of prostate. Very broad base.
Fig. 23. Primary carcinoma of prostate.
Fig. 24. Carcinoma of prostate.
Fig. 25. Cystograph after extensive resection of bladder for carcinoma (female).
Fig. 26. Same as Fig. 25, four months later.
Fig. 27. Carcinoma of bladder. Note filling defect above. Broad base as seen in benign hypertrophy.

This group of cases furthermore demonstrates that cystography should be used supplementary to cystoscopy, and *not instead of it.*

Urinary symptoms due to pelvic lesions in women are not uncommon. Not infrequently pus is also found in the urine, and the conclusion is often reached that the lesion must

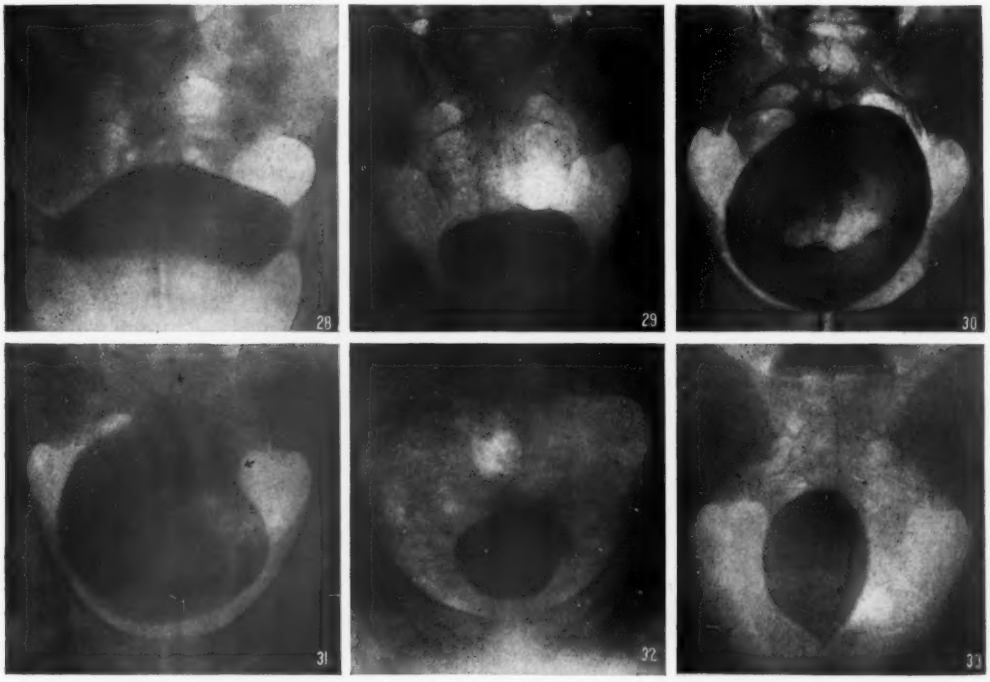

Fig. 28 (at upper left). Large epithelioma of bladder, female.

Fig. 29. Carcinoma of bladder. Carcinoma situated in apex of bladder. Note filling defect.

Fig. 30. Cancer of bladder. Note light center and dark periphery.

Fig. 31. Cancer of the bladder. Note the light mottled area corresponding to the tumor. An irregular shadow at apex.

Fig. 32. Extensive carcinoma of the bladder. Extension from carcinoma of the uterus.

Fig. 33. Chronic prostatis.

be urinary in character. It is in this group of cases that cystography may lead to a wrong diagnosis unless other methods of diagnosis are resorted to. The filling defects as demonstrated in some of the cystographs obtained in cases of parametritis (Fig. 10) in no way differ from the defects seen in some cases of primary carcinoma of the bladder. This is seen in Figs. 11 and 12, Fig. 11 showing a filling defect due to an enormous fibroid with an associated colon bacillus pyelitis; Fig. 12 a defect caused by an enormous carcinoma of the uterus, which involved the bladder.

ACCESSORY SHADOWS

The three cases in which there was some irregularity in the cystograph, it was thought desirable to discuss in a group by themselves. In Fig. 13 there is an apparent, different density of the shadow, the darker part being found on the right side and in general resembles those obtained in fibroid, or in some carcinomata of the bladder. The second or lighter area extends to the left side. The first impression is that one is dealing with a double bladder, or that this picture is due to some intravesical lesion. This, however, can be excluded as cystoscopy was negative. Pelvic examination was negative, so that the bladder and generative organs were normal. It would seem reasonable therefore, to attribute this phenomenon to an invagination of the bladder by a full bowel.

A second case showed what might be termed an extra shadow, sitting as it were on top of the bladder shadow. This is less dense than the rest of the shadow (Fig. 14). The pa-

tient had had a suprapubic operation, as well as several fulgurations for multiple papillomata. When this cystograph was taken his bladder was normal.

The third case occurred in a carcinoma of the bladder (Fig. 31).

DIVERTICULA

Although diverticula can generally be recognized by the cystoscope, it does not give one any accurate idea regarding the extent of each diverticulum. In cases in which the extent, often also the number, of diverticula are to be demonstrated, cystography offers the best single method at our command. That roentgen rays were a desirable method of diagnosis in these cases was recognized in 1904 and 1905 by Kellar, who distended the bladder with air. In instances in which the diverticulum may be situated between the bladder and the rectum, its shadow may be obscured by the dense bladder shadow, hence the necessity of examining the patients with the fluoroscope prior to taking the roentogenograms, which had better be taken at several angles. The cystographs show the different sizes, shapes, and positions of the diverticula. In two of the three cases the general contour of the bladder was lost, due to the size, shape, and positions of the diverticula. In Fig. 15 the bladder has fairly retained its shape, and the diverticula appear as appendages of the bladder. Doubtless cystography will often give one a better idea of diverticula than will cystoscopy, and doubtless its one big value lies in this group of cases.

CHANGES CAUSED BY LESIONS OF THE PROSTATE

Benign hypertrophy of the prostate and the resulting changes in the bladder have been subjected to this mode of examination and fairly constant cystographs have been obtained. The cystograph in these cases generally shows a broadening or widening of the base, so that the pear-shaped or spherical shaped bladder becomes very broad with the narrow part placed upward, being just the opposite of the pyriform bladder (Fig. 18).

In some cases the enlarged gland seems to elevate the bladder so that it is carried away from the symphysis. The two changes have been recorded frequently, and are put down as bladder changes due to the benign hypertrophy.

While in most of the cases examined, pictures such as those just described have been obtained, in some of the roentgenograms pictures were obtained that deviated slightly from those just described. In Fig. 19 there is no broadening of the base. The upper part of the bladder is smaller than the base, and between these two can be seen a narrowing, so that a remote resemblance to an hour glass is seen. From this cystograph one could not have made a diagnosis of benign hypertrophy. In Fig. 20 there is no resemblance to a broad base. The bladder is very large (500 cubic centimeters). Its margin very irregular, due to small diverticula formation.

In one case of a small, hard, fibrous prostate, an elongated picture was obtained, just the opposite of that usually seen in hypertrophy (Fig. 21). This picture very closely resembled that obtained in a case of chronic prostatitis, so that from the cystograph alone, it would have been impossible to have made an accurate or differential diagnosis. When a typical cystograph is obtained, a diagnosis of prostatic hypertrophy may be ventured. Failure to obtain such a cystograph does not necessarily exclude benign hypertrophy.

In carcinoma of the prostate nothing in the way of typically uniform roentgenograms were obtained. In one (Fig. 22) a very extensive broadening of the base of the bladder was demonstrated. There was nothing by which this could be differentiated from a benign hypertrophy. Another cancer of the prostate showed a broad base with an elevation of the base (Fig. 23). There was also a slight defect in distention. In one of the cases the bladder was very much contracted, so that a very small amount of fluid was introduced. The small roentgenogram, however, showed a broad base (Fig. 24).

TUMORS

In rare instances it may be impossible to carry out a satisfactory cystoscopic examination, so that the size, location or nature of the

tumor cannot be determined. It is in such instances that one would welcome some adjunct to our present diagnostic methods, provided it were reliable and did not have too many possibilities of misinterpretation.

A. For example, in *papillomata* that are undergoing or have undergone malignant changes at the base — in these tumors the part growing into the bladder may have the usual cystoscopic appearance of a benign papilloma, yet the base may have undergone malignant change. If this malignant change should extend into the muscularis so that a lack of distention is present and we are able to demonstrate this by cystography, then this might aid in simplifying the question of benignancy or malignancy. If this defect has been definitely established, one would perhaps consider resection or radium treatment, instead of resorting to fulguration, or perhaps a combination of the two latter, that is radium and fulguration. On the other hand, this method may fail to give this information. In one case of *supposedly* benign papilloma, a normal cystograph was obtained. Histological examination revealed extensive carcinomatous changes in the tumor and as just mentioned a normal cystograph was obtained.

B. In the *carcinomata* our results have shown three distinct phenomena. These changes were: (1) a defect of distention; and (2) a variation in the density, although the outline was normal; (3) a diminished bladder capacity, so that a very small bladder picture was obtained.

The filling defect occurred in carcinomata irrespective of their size. The larger carcinoma did not show this filling defect, but presented a light, more or less mottled, center. These might be suggestive of papillary carcinomata growing into the bladder, but not invading the bladder wall (Figs. 25, 26, 27, 28, 29, 30, 31, and 32).

In the cases of abscess of the prostate, in which cystography was carried out, normal cystographs were obtained. In one case of prostatic calculi, this method gave us no additional information, other than that obtained by a plain roentgenogram.

In a case of chronic prostatis an oval bladder was demonstrated which closely resembled a cystograph obtained in a case of small, fibrous prostate with complete retention (Fig. 33). A differentiation from the cystographs alone was impossible.

CONCLUSIONS

1. Cystography is a valuable adjunct to our present diagnostic methods.
2. Cystography will always have a limited field of usefulness.
3. Great care must be exercised in interpreting cystographs.
4. Because of its limitations and possibilities of misinterpretation, cystography can never hope to take the place of cystoscopic examination, but should be used as an adjunct to it and not instead of it.
5. Cystography may be of aid in determining whether resection or fulguration should be employed in a certain percentage of papillary tumors.
6. For outlining the number, size, and position of diverticula, cystography is easily the method of choice.
7. That regurgitation of fluid from the bladder into the ureter is possible in normal individuals, has been demonstrated in some of the cases embodied in this report.
8. It has also been possible to demonstrate a regurgitation of fluid from bladder into ureter, in the presence of bladder infection, though the ureteral orifice appeared normal.

CALCIFIED GLANDS PROXIMAL TO THE COMMON BILE-DUCT; CYSTICODUODENAL LIGAMENT

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CALCIFIED glands proximal to the common bile-duct are sufficiently rare to render the report of the present case of interest. W. J. Mayo[1] mentions having seen one such case in his experience. I have observed it but once in several thousand laparotomies in which the condition of the biliary apparatus has been carefully observed.

The anomaly mentioned, the presence of a cysticoduodenal ligament, is not so very rare but is of operative importance in dealing with stones in the cystic and more particularly the middle portion of the common bile-duct. In either location the ligament is best split longitudinally and separates readily into an anterior and posterior leaf allowing of complete exposure of the portions of the ducts above mentioned.

Serial No. 557. G. H. No. 31166. A. C., age 32, Italian bartender of Brooklyn, admitted March 8, 1915. *Operation*, March 9, 1915. Cholecystostomy. Choledochotomy. Discharged March 28, 1915, cured.

[1]J. Am. M. Ass., 1911, April 8.

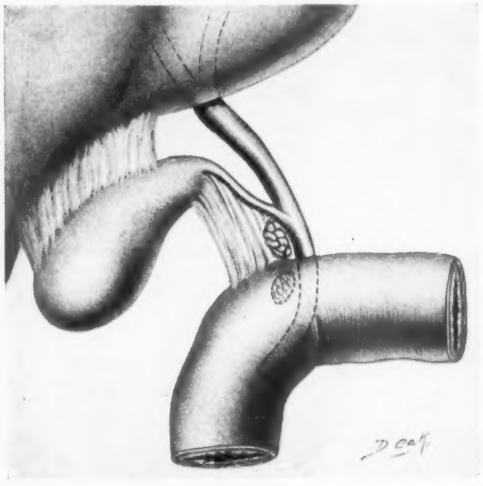

Fig. 1. Calcified glands in relation to the common bile-duct. Cysticoduodenal ligament.

History. In November, 1913, there was an acute attack of severe abdominal pain accompanied by jaundice, nausea, and vomiting, lasting for twenty days with slight remissions. The pain was most severe in the region of the gall-bladder, and at times there was pain in the right shoulder. There have been several similar attacks, one in February, 1914, lasting fourteen days; one in May, 1914; one in November 1914; the last attack, February 25, 1915, lasting three days and with slight jaundice. There is no history of syphilis.

Examination March 9, 1915. Slight tenderness in gall-bladder region. No evidence of syphilis. *Diagnosis.* Cholecystitis, chronic.

Operation. Cholecystostomy and choledochotomy. Gall-bladder distended but apparently normal. Cysticoduodenal ligament present. A hard mass about the size of a filbert, thought to be a stone, could be palpated at the lower part of the middle portion of the common duct (see Fig. 1). The tissues over this mass were incised and a mass of calcified material exposed. Following the removal of this there was no discharge of bile. It was then suspected that the material came from a calcified gland. A second smaller gland, also calcified, was discovered lying below the first and behind the duodenum. This gland was also removed. The gall-bladder was opened. Its interior showed slight evidence of old inflammation (cholecystitis catarrhalis chronica). The walls were thin, the bladder distended. Contents: bile with slight colon odor. The common duct was incised. A probe was passed through the common duct into the duodenum, and it was demonstrated that the hard masses were indeed external to the duct. Other glands were not enlarged.

Pathological examination. Calcified lymph-nodes. Wassermann negative.

After-course. Uneventful. Discharged March 28, 1915. Healed April 25, 1915.

Comment. This was either a case of non-calculous cholecystitis or it is possible that the stone or stones had escaped during the attacks. It would have been better to have removed the gall-bladder since it presented pathologic changes, but considerable time had been spent in palpating and examining the ducts and the relation of the calcified

glands to the common duct; moreover, the patient bore the anæsthetic badly. There has (April 1, 1916) been freedom from attacks since the operation. It is probable that the case is one of non-calculous cholecystitis, and that this together with the calcified glands along the common duct through pressure on the duct produced the symptoms. This supposition is the more tenable as other glands were not enlarged. If so, the condition is extremely rare and incapable of being differentiated clinically.

IS THE EMPLOYMENT OF THE ACTUAL CAUTERY IN THE TREATMENT OF CHRONIC ULCER OF THE STOMACH A SAFE PROCEDURE

By CHARLES L. SCUDDER, M.D., Boston
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AND
SAMUEL C. HARVEY, M.D., Boston
Fellow in charge of the Laboratory of Surgical Research, Harvard Medical School

DR. D. C. BALFOUR described in a well-illustrated article, two years ago, a method of treating certain chronic ulcers of the lesser curvature of the stomach by the application of the actual cautery followed by suture of the cauterized area.[1] We believe that this suggestion of Balfour is a valuable one. We believe that it is an important addition to the procedures at the disposal of the surgeon operating for chronic ulcer. We have used the cautery following the technique that Balfour suggested in ulcers of the lesser curvature of the stomach. We have also through a gastrotomy wound in the anterior wall of the stomach destroyed by means of the actual cautery ulcers upon the *posterior* wall of the stomach, and have followed the cauterization with a suture of the ulcerated cauterized area.

It was an interesting phenomenon that following the thorough cauterization of the hard, indurated wall of the ulcer, it was noticed that the induration had disappeared and that the cauterized edges of the previously indurated ulcer could be comparatively easily approximated by suture.

We have been particularly interested in determining whether there is any difference in the reparative process taking place after cauterization of the stomach-wall as compared with the reparative process following a simple incision with the knife. In order to determine what happens under these two conditions, certain experiments upon dogs were performed. This paper is concerned with a report upon these animal experiments.

In subjecting to experimental study the inflammatory reaction and the process of repair following incision of the stomach with the acutal cautery, it seemed best to rest content with determining the damage done and the rapidity of repair as compared with a similar incision made with the knife, rather than to attempt the elaborate and detailed histological investigation necessary to a complete description of the reaction to this particular type of injury. With this end in view the following experiments were carried out.

METHOD

Adult, healthy dogs were used throughout, and anæsthesia was induced with ether by the cone and maintained by intratracheal insufflation. A left rectus incision was employed through the anterior abdominal wall in the epigastrium, a large enough opening being made to permit of the free exposure of the stomach by drawing it up into the wound where it was held by the fingers of an assistant or by a stomach clamp gently applied. After thoroughly walling off with moist gauze, the incision was made with the cautery or the knife as indicated in the

[1] Surg., Gynec., & Obst., 1914, xix, 528.

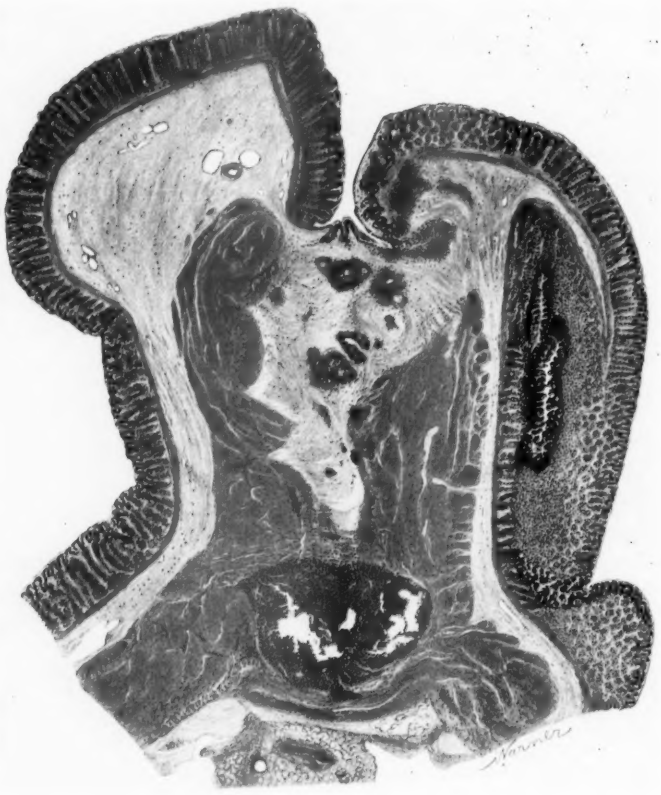

Fig. 1. Dog 5, Specimen No. c25. Incision by cautery fifteen days previously. Note the flattened epithelium in the mucosa over the site of the scar, also the deficient muscularis mucosæ over a rather wide area. In the line of the incision are several areas of cellular infiltration marking the sites where suture material is being absorbed.

individual protocols. The Paquelin cautery was used at a rather intense red heat—not white—and was carried slowly through the entire stomach-wall, injury to the adjacent tissue being avoided by the use of gauze wet in salt solution.

The incision with the knife was made through the stomach-wall as far as the mucosa, while the latter was divided with the scissors. All incisions were from 5 to 8 centimeters in length and located in the anterior wall of the stomach at the junction of the antrum pylori and the fundus, unless otherwise stated in the protocol. The same method of closure was used in every instance, the detail of placement and spacing of the sutures being kept as uniform as possible. The mucous membrane was approximated with a continuous No. 0 or No. 1 chromic catgut suture, and a similar over-and-over running suture used to approximate the muscle and serosa of the stomach-wall. The line of incision was then further inverted and reinforced by interrupted mattress sutures of fine Pagenstecker linen. The abdominal wall was closed in layers with silk, continuous in the peritoneum and interrupted in the muscle, fascia, and skin. The dogs were given water after 12 hours and meat juice and bread after 24 hours, in four days being

placed on their usual diet. Skin sutures were removed in six days.

The tissue removed at subsequent operation or autopsy was fixed in 10 per cent formalin, embedded in celloidin or paraffin, and stained with Delafield's hæmotoxylin and eosin.

PROTOCOLS

Dog 1. Medium sized black mongrel dog. December 6, 1915: incision with cautery about 8 centimeters in length. Closure satisfactory with omentum sutured over line of incision in the stomach. December 28, 1915: post-operative condition has been satisfactory in every particular. The portion of the stomach operated upon previously was removed with cautery and placed in formalin. Stomach closed as in previous operation. Specimen No. p829. December 30, 1915: dog died today from pneumonia following exacerbation of "distemper" incident to operation. Portion of stomach including the line of incision of last operation placed in formalin. Specimen No. p828.

Dog 3. Medium sized collie dog. December 21, 1915: incision with cautery through stomach-wall and closure as given above. December 26, 1915: dog died today from pneumonia. Stomach removed and placed in formalin. Specimen No. p831.

Dog 4. January 31, 1916: incision of stomach with cautery and usual closure. February 23, 1916: post-operative condition normal. Line of previous incision removed with knife and the stomach closed as customary. Specimen No. c23. March 17, 1916: dog killed and specimen of stomach placed in formalin. Specimen No. c28.

Dog 5. February 8, 1916: incision in the stomach by means of the cautery with the customary closure. February 23, 1916: portion of stomach previously incised removed with knife and placed in formalin. Usual method of closure for the stomach employed. Specimen No. c25. March 17, 1916: dog killed with ether and stomach placed in formalin. Specimen No. c30.

Dog 6. February 11, 1916: Stomach-wall incised near the pylorus with the knife and closed as in the previous experiments. A second incision was made near the fundus with the cautery and closure carried out as usual. March 17, 1916: dog killed with ether and the sites of the incisions identified, removed, and placed in formalin. Cautery incision, Specimen No. c26. Knife incision, Specimen No. c27.

Dog 7. Medium sized female dog. March 17, 1916: stomach incised with knife and the customary closure employed. March 22, 1916: dog killed, and stomach fixed in formalin. Specimen No. c23.

Dog 8. March 20, 1916: incision in stomach with knife with usual closure. March 22, 1916: scar of former incision excised and stomach closed in customary manner. Specimen placed in formalin. Dog killed later. Specimen No. c31.

Dog 10. May 1, 1916: stomach incised with knife and closed as usual. May 17, 1916: dog killed and stomach placed in formalin. Specimen No. c32.

DESCRIPTION OF SPECIMENS

Cautery 2 days. Dog 1. Specimen No. p828. *Gross.* Specimen of stomach-wall with tags of omentum adherent over the peritoneal surface along the line of the incision. The stomach-wall is markedly inverted along this same line so that the mucosal surface shows a ridge 8 to 10 millimeters in height. At the crest of this ridge and running the entire length is an ulcer some 2 to 4 millimeters in breadth extending only into the submucosa. On cross section the submucosa is seen to be swollen so that it measures some 3 to 4 millimeters in thickness with the ulceration spoken of above extending about one-third of the distance through it. The whole is infiltrated with blood-pigment. The muscle layers are held in apposition by the sutures and show no areas of necrosis. The damage, as measured by the œdema of the submucosa, seems to extend about 8 millimeters on either side of the line of incision, only 1 to 2 millimeters of this, however, being sufficiently severe to produce death of the mucosa.

Microscopic. A shallow ulcer is present at the crest of the inverted ridge, the base of which is made up of submucosal tissue infiltrated with red blood-cells and leucocytes. Some of the smaller superficial vessels at the base of the ulcer are thrombosed. Many polyblasts and phagocytic cells are seen, some of which are filled with blood-pigment. The mucosa at the edge of the ulcer, for a short distance, shows some superficial erosion, the deeper cells being intact. There is but little effort at regeneration of this layer as yet. The muscle edges end sharply without any definite necrosis, but where caught in the stitches there is hyaline degeneration of a few bundles. The peritoneal surfaces are approximated, the superficial cells having disappeared, and the whole is covered by the loose areolar tissue of the omentum.

Incision 2 days. Dog 8. Specimen No. c31. *Gross.* The stomach-wall is inverted along the line of the incision, forming a ridge some 7 to 9 millimeters in height over the length of which, in contrast to the preceding specimen, the mucosal edges of the incision are in contact, leaving no ulcerating surface apparent to the naked eye. The submucosa is swollen, œdematous, and markedly injected, being 5 to 6 millimeters in depth, and this condition extends 7 to 9 millimeters on each side of the line of incision. The muscle layers are in good apposition and show no gross evidence of damage. The peritoneum is thickened and in places adherent to the omentum along the line of incision.

Microscopic. The mucosa is intact on either side right up to the edge of the microscopic ulcer extending along the crest of the invaginated stomach, and one can make out the flattened epithelial cells beginning to spread downward upon the submucosa exposed at the base. The latter is œdematous for

Fig. 2. Dog 10, Specimen No. c32. Incision by knife sixteen days previously. Note the mucosa nearly normal in appearance and also the small amount of scarring in the muscularis mucosæ. The suture has pinched off the muscle toward the base of the section and there is some cellular infiltration about the remains of the catgut.

some distance from the incision and infiltrated with many red blood-cells, leucocytes, and relatively rare polyblasts and wandering cells. Throughout the whole submucosa and extending between the cut muscle edges as far as the peritoneum is a marked fibrin meshwork. The muscle shows no pronounced degenerative changes and is well approximated. The peritoneum is œdematous over the line of incision and contains much fibrin with a few wandering cells.

Cautery 5 days. Dog 3. Specimen No. p831. *Gross.* The invagination in this specimen produces a ridge only 4 to 5 millimeters in height, which consists for the most part of the invaginated musculature. The mucosa is continuous over the line of incision, at this point showing a deep cleft only. There is scarcely any œdema or infiltration of the submucosa to be observed by the naked eye, aside from a small amount of blood pigment. The peritoneum is rather thicker than normal with dilated vessels at the line of incision and there are a few tags of adherent omentum.

Microscopic. At the base of the deep cleft in the mucosa noted above, the membrane is represented for a very short distance by flattened epithelial cells. Elsewhere it seems to have been restored to its normal condition. The submucosa is now only slightly thicker than normal and is made up for the most part, immediately adjoining the line of incision, of granulation tissue. There are a few thrombosed vessels in which organization is in progress, and in the vicinity of these many phagocytic cells containing blood-pigment. The muscle shows areas of hyaline degeneration in the immediate neighborhood of the sutures but not elsewhere.

Incision 5 days. Dog 7. Specimen No. c23. *Gross.* The stomach-wall is sharply invaginated to a depth of 10 millimeters and the mucous membrane covering this projection seems normal everywhere, with the exception of a very narrow cleft along the incision line, at the bottom of which it is difficult to say whether healing is complete or not. The submucosa seems thicker than normal in the neighborhood of the incision but not œdematous. The muscle shows, where the blood supply has been interfered with by the approximation sutures, some degeneration which is not extensive. The peritoneal coat is slightly thickened.

Microscopic. One edge of the mucosa was inverted at the operation, accurate approximation not being obtained. Consequently at the bottom of the cleft noted above, there is a considerable area of granulation tissue covering the submucosa over which the epithelium has not as yet grown. The submucosa in this immediate neighborhood shows some fibrin and leucocytes as well as fibroblasts, young blood-vessels, and cells characteristic of pure granulation tissue. The muscle-bundles contiguous with this have undergone complete degeneration, being replaced in large part by fibroblasts. At a greater distance the muscle seems intact and this scarred area probably represents a portion of the wall compressed by a suture, which is seen nearly surrounded by a mass of leucocytes. Beneath the peritoneum there is a small mass of fibrin and this structure is still somewhat œdematous.

Cautery 15 days. Dog 5. Specimen No. c25. *Gross.* The marked invagination of the stomach-wall is not so apparent as in the previous specimens. The mucosa along the line of incision dips down sharply to meet the scar-tissue in the muscle and is completely healed. The submucosa in the immediate neighborhood is thickened, but over the line of incision in the muscle is almost absent. The muscle itself seems normal aside from the strands of chromic gut which are seen surrounded by a narrow zone of inflammatory reaction. The peritoneal coat is thickened.

Microscopical (see Fig. 1). The mucosal defect is completely healed with a small area in which the glands are still lacking. The submucosa directly over the scar as well as the muscularis mucosæ are deficient here, and the former is made up for the most part of quite cellular young fibrous tissue. In the scar between the muscle-bundles are seen some strands of the catgut sutures which have not yet

been completely absorbed. These are surrounded by clumps of cells, many of which are endotheliod in appearance. Near the peritoneal surface is a similar nest about a suture in which many of the cells, especially in the center, have become necrotic. The peritoneal surface is covered with omental tissue.

Incision 16 days. Dog 10. Specimen No. c32. *Gross.* There is a slight invagination of the stomach-wall consisting in the main of the musculature. The mucous membrane is continuous over the scar and it is quite difficult to tell from inspection of the inner surface of the stomach precisely where the incision was made. The submucosa seems of normal thickness except for some thinning directly over the scar and a slight thickening on either side. There are two muscle-bundles in the scar which give the appearance of having been detached from the remainder of the muscle-wall by tightly drawn sutures. The peritoneum is slightly thickened immediately over the line of incision, and the omentum is adherent in two or three places.

Microscopic (see Fig. 2). The mucous membrane directly over the scar is made up of flattened epithelium, and the muscularis mucosæ in this same area is not seen. The submucosa in the same region is replaced by a thin layer of scar tissue and in the immediate neighborhood is made up of quite cellular young fibrous tissue. This merges with the muscle-bundles directly beneath, which have been replaced in part by connective tissue. The muscle itself seems normal except at the base of the section where it is partially cut off from the adjacent muscle-wall by a band of connective tissue, evidently the result of the constrictive action of a suture. The sutures have been absorbed, though there are still left some areas of cellular infiltration marking their former situations.

Cautery 24 days. Dog 4. Specimen No. c23. *Gross.* In the mucous membrane over the line of incision there is a distinct depression although it is somewhat difficult to tell this from a normal sulcus. Its intimate attachment to the underlying scar tissue, however, serves to differentiate it. The submucosa is thickened on either side, while the muscle layers seem to be normal aside from the areas of connective tissue produced by the constriction of the sutures. The peritoneal surface is thickened in the immediate vicinity of the incision.

Microscopic. The mucous membrane is continuous over the scar, showing columnar epithelium throughout, although the glands are still lacking over a small area at the base of the indentation. The muscularis mucosæ is identified over this same region. The submucosa is considerably thickened in the immediate neighborhood of the scar, being made up in greater part of loose connective tissue, although the mucosa is in one place in almost direct contact with the muscle wall. The muscle shows some areas of cellular infiltration undoubtedly the remains of the cellular reaction to the sutures which have been absorbed. There are two or three places in which newly formed connective tissue is present. The peritoneal surface is everywhere covered with omentum.

Incision 23 days. Dog 5. Specimen No. c30. *Gross.* The mucous membrane is sharply invaginated and bound down to the underlying muscle-wall over the line of incision, so that the groove produced resembles one of the normal sulci. The submucosa is missing over the scar and is not especially thickened elsewhere. The muscle-bundles are interrupted in places by connective-tissue strands, but on the whole seem quite normal. The peritoneum is covered everywhere by adherent omentum.

Microscopic. The mucous membrane over the scar is made up of columnar epithelium with some newly formed glands which, however, are not as deep or as numerous as in the adjacent normal membrane. The muscularis is directly continuous with the muscle-wall, while the submucosa is missing at this point, being elsewhere but little changed from normal. The muscle-wall seems quite normal aside from the presence of a few cellular masses, evidently the remains of the absorption of a suture. The peritoneum is directly continuous with omentum and is somewhat more cellular than normal.

Cautery 35 days. Dog 6. Specimen No. c26. *Gross.* The mucosa is thinned out and intimately adherent to the underlying muscle-wall along the line of incision. The submucous tissue is not markedly thickened, although the muscle-bundles contain considerable connective tissue. This is especially true between the approximated muscle-walls. The peritoneum is distinctly thickened over the site of the scar.

Microscopic. The mucosa is intimately adherent to the underlying scar but shows everywhere the normal columnar epithelium, the glands in one area, however, being very apparently newly formed. The submucosa and muscularis are absent as distinct structures over the region of the incision, the mucosa being practically in contact with the muscle layer at this point. One bundle of muscle probably had had its blood supply obliterated by a suture, being replaced by granulation tissue with many young blood-vessels. The peritoneal coat is somewhat thickened.

Incision 35 days. Dog 6. Specimen No. c27. *Gross.* The mucosa dips down so as to form a distinct sulcus much like the normal depression immediately adjacent. It is also thinned out at this point and in direct contact with the muscle-wall. The submucosa on either side does not seem unduly thick. There is a scar extending through the muscle-wall at the line of incision and the peritoneal surface of the latter is covered with omentum.

Microscopic. The mucosa shows the normal lining epithelium and in the neighborhood of the line of incision many young glands. It is directly in contact with the scar in the muscle-wall. The submucosa and the muscularis are converted into

a thin band of scar tissue in this same area, slightly less extensively, however, than in the preceding section. The muscle-wall is completely healed without any unusual amount of scarring. The peritoneal coat is directly continuous with the omentum.

CONCLUSIONS

A study of these experiments with a view to the determination of the relative damage done by the actual cautery and by the knife, and the relative rapidity of repair, shows the following:

The amount of tissue injured by the actual cautery is perhaps slightly greater than that by the knife. This is shown by the presence of a small but definite mucosal ulceration in the two days' specimen following the cautery, while the mucosa in the section, made two days after the knife incision, was completely grown across the line of incision. Further and more conclusive evidence is furnished by a comparative study of the extent of damage done to the muscularis mucosæ by the two methods of incision. Such a study shows invariably a slightly greater damage and a slightly greater scarring of the structures in the incisions made with the actual cautery. However, this difference is scarcely apparent without microscopical examination.

A marked difference in the rapidity of repair was not demonstrated by this study.

It appears from this brief experimental work that the suture of the cauterized margins of the stomach-wall is attended by practically a normal reparative process similar to the reparative process following a simple incision with the knife. This having been demonstrated by the actual study of the areas involved may serve, it seems to us, to show that the method is a safe method for ordinary use in the human.

It seems to us that the indications for the employment of the actual cautery in cases of chronic ulcer in the human may be stated somewhat as follows:

The method is applicable to a chronic ulcer seated upon the lesser curvature so far away from the pylorus as to make its easy removal by excision difficult. Such an ulcer may be cauterized from the center out, as suggested by Balfour, so that the loss of substance occasioned by the cauterization may be as large as one and a half inches or more in diameter and the edges may be then approximated with the assurance of a proper healing of the wound.

Ulcers seated on the posterior wall of the stomach which are safely approached by a gastrotomy incision, as suggested by W. J. Mayo, may have their *edges* thoroughly cauterized and also the *base* thoroughly cauterized even when it is adherent to the pancreas, and be sutured with the assurance to the surgeon that the reparative process will proceed satisfactorily.

Certain chronic ulcers adherent to the posterior parietes and pancreas do not lend themselves to easy and safe excision and suture. The cautery is sometimes applicable to this special group of cases.

The cautery will destroy any beginning cancer in the edges of the ulcer if the cauterization is thoroughly done. The employment of the cautery saves considerable time over the simple excision method. It is a fact generally recognized that in order to close the stomach following a simple excision of a portion of the gastric wall a very large wound remains to be sutured. It is a fact that following the use of the cautery no such large gaping wound exists, and the stomach is closed more readily than after wide excision by the knife.

We believe that in the conduct of this procedure of cauterization, as also in the conduct of simple excision of a portion of the stomach-wall, the stomach should be very carefully mobilized and the part to be operated upon controlled, so that the portion actually cauterized is rendered accessible. The hand of an assistant introduced into the abdomen grasping the chronic ulcer from the outside is of great assistance in simplifying the operation. Clamps are not often needed for protection from soiling or to prevent hæmorrhage.

The suture material employed in human cases in each instance has been No. 1 chromic catgut. It has not been found necessary to reinforce the sutured area by interrupted linen suture of the peritoneal surface in all cases. If it is possible to place these interrupted linen sutures it is wise to do so. Following any extensive plastic of the stomach, a gastro-enterostomy should be done (Mayo).

DEPARTMENT OF TECHNIQUE

A TECHNIQUE FOR SUPRAPUBIC PROSTATECTOMY UNDER LOCAL ANÆSTHESIA[1]

By B. S. BARRINGER, M.D., New York
Adjunct Assistant Urologist, Bellevue Hospital

LEGUEU[2] in 1914 suggested the possibility of performing prostatectomy under local anæsthesia, describing the technique and various shaped needles with which the prostate might be anæsthetized through the suprapubic opening. In the four cases here reported I have tried different methods of anæsthetizing the capsule of the prostate. While in each the method has varied, and while in but one was the preliminary dose of morphine given, in each I succeeded in completing the operation, using only local anæsthesia.[3]

Technique. A preliminary dose of ¼ grain of morphine is given one-half hour before the operation. The bladder is opened using a median incision and the usual technique by local anæsthesia. The opening in the bladder is high and wide enough to introduce two fingers; ½ or 1 per cent novocaine is used both to anæsthetize the skin, the bladder, and the sheath of the prostate. The bladder opened, the prostate and its sheath are thoroughly infiltrated with 1 per cent novocaine using a 4-inch 18-gauge needle. Particular care is taken to anæsthetize the portion of the prostate sheath between the lateral lobes (to the depth of ½ to 1 inch) as this is where the first tear into the sheath is made and where pain may be expected. During these manipulations a gloved finger of the left hand is introduced into the rectum and this is used both as a guide to the infiltration and to lift up the prostate. The glove is taken off the right hand — the hand which is used for the intravesicle manipulations. After waiting about 5 minutes the index finger of the right hand tears through the superior wall of the urethra into the prostatic sheath following the technique of Squier. I believe that a slight cut with scissors or knife through the urethra would probably be better and less painful than tearing all the way through with the finger. When the patient feels pain the tearing is stopped and the prostatic sheath further infiltrated, the infiltration keeping pace with the operation and with any suggestion of pain experienced by the patient. The finger in the rectum prevents the needle from going too deeply. With great gentleness and using all the time that is needed (the whole operation takes from 30 to 40 minutes) the prostate is shelled out. If the final shelling out causes too much pain a whiff of gas can be given to the patient. I think, however, that this will be rarely necessary if the operator calmly takes his time. I believe it is the hurry to get the prostate out that in most cases causes pain.

Pain versus shock. Three of my patients had some slight pain; one had considerable pain because I attempted to remove lateral lobes which did not exist. This last patient had a slight amount of shock as shown by some paleness and sweating of the face and slightly increased pulse rate. The other three had absolutely no shock; their pulse stayed precisely the same as before operation. The last patient, after the removal of a good sized prostate, was sitting up in bed reading the paper when I left the hospital. It is a question if it is not better to let a patient feel a slight amount of pain if by so doing you can keep from using a general anæsthetic and perform a serious operation with no shock. I believe most patients would rather bear such slight pain than have a general anæsthetic, but I also believe it is a question how much pain you should let a patient bear before resorting to a few whiffs of gas or ether; ½ or 1 per cent novocaine has been used in as large quantities as necessary to anæsthetize the sheath of the prostate. Novocaine seems to be practically non-toxic. Of course I should hesitate to use more than 4 or 5 grains for the entire operation. The following is a brief résumé of the four cases.

[2] Anesthesie locale de la prostatectomie. J. d'urol., 1914, June.

[3] At first I tried to anæsthetize the prostatic urethra and the capsule of the prostate by introducing a 4-inch 18-gauge needle through the perineum into the prostate, a guiding finger being in the rectum. This does not seem to work as well as doing the whole operation suprapubically.

[1] Read at the American Association of Genito-Urinary Surgeons, Washington, May 9, 1916.

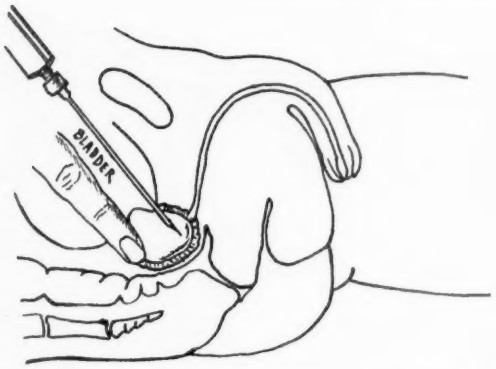

Fig. 1. Sheath of prostate infiltrated with 1 per cent novocaine. Needle introduced through opened bladder.

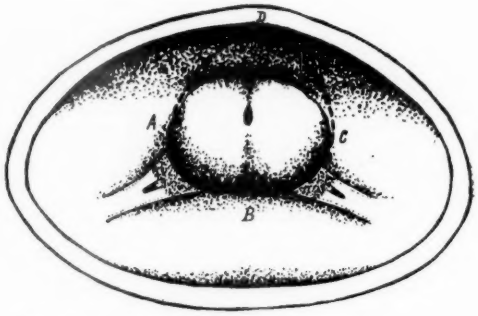

Fig. 2. Area of infiltration of prostate *A*, *B*, *C*, *D*. Infiltration extending well above prostate *D* where first tear into the prostate sheath is made.

CASE 1. A. M., age 66. History of urinating for some months two to four times at night. The prostate was enlarged rectally and cystoscopy shows a bifurcate middle lobe. He had 16 ounces of residual urine when first seen and when operated upon had complete retention. Blood pressure 156. Intramuscular phenolsulphonephthalein appeared in 25 minutes and 45 per cent was excreted in the first hour thereafter.

Bladder opened under novocaine and the capsule of the prostate infiltrated with novocaine and the prostate removed. He had some slight pain at the final shelling out of the prostate. The suprapubic wound closed up two weeks after operation. His convalescence was complicated by a popliteal phlebitis. Two months after operation he was getting up two to three times at night, had a residual of 2 drams.

CASE 2. P. L., age 69. History of difficulty in urinating for fifteen years. Two weeks before seen, complete retention. Later he partially regained control and had from 6 to 8 ounces of residual urine. Phenolsulphonephthalein appeared in 7 minutes, 42 per cent in the first hour, and 17 per cent in the second. He had a large prostate by rectum and the cystoscopy showed an irregular horse-collar prostate. This patient was given preliminary infiltration anæsthesia of the prostate by means of a needle introduced through the perineum. This was supplemented by anæsthetization of the prostate capsule through the suprapubic wound; ½ per cent novocaine was used to anæsthetize the skin and bladder, and 1 per cent the prostate and its capsule. Slight pain was felt at the final shelling out of the prostate, but the patient had practically no bleeding and no shock. Bladder wound closed on the sixth day so that he was passing all his urine by urethra. When the patient left the hospital two weeks after operation he had no residual.

CASE 3. J, age 65. Comes with a history of night urination for some time; up three or four times. Residual urine about 3 ounces. Cystoscopic examination showed a median lobe enlargement of the prostate. Phenolsulphonephthalein output normal. The bladder was opened under novocaine and an attempt was made to remove any lateral lobes which might be present. No lateral lobes were present, and in this attempt the patient was hurt considerably. The median lobe was taken out without trouble. He left the hospital three weeks after operation with his suprapubic wound healed and with a dram of residual.

CASE 4. X. This patient was operated upon at the Nyack Hospital and a suprapubic incision had been made two weeks before I saw the patient. He was a man of about 60; he came to the hospital with complete retention and he had a very large prostate by rectal feel. No cystoscopy was done and no preliminary functional tests. The suprapubic wound was granulating and I hurt the patient more in opening this up and getting into the bladder than doing the prostatectomy. The prostate was anæsthetized with novocaine and shelled out. It was so large that I had to deliver it through the suprapubic wound with a pair of forceps, pulling quite vigorously to get it out. The patient had no shock and no bleeding. The wound was packed with gauze and the patient was sitting up in bed when I left the hospital. I did not see him thereafter, but heard from his physician that he had left the hospital about a month later. The wound healed nicely but he was not tested for residual urine.

SUMMARY

In most cases prostatectomy can be accomplished under local infiltration anæsthesia, and if it is so done the shock of operation, the trauma of tissues and possibly hæmorrhage are apparently less than if a general anæsthetic is used. Novocaine is the anæsthetic of election. The operation takes longer than when done under a general anæsthesia.

AN ABDOMINAL OPERATION FOR THE CURE OF CYSTOCELE

By F. G. DUBOSE, M.D., F.A.C.S., Selma, Alabama

THERE are many surgeons who prefer the abdominal to the vaginal route for the performance of pelvic operations. In presenting this intra-abdominal operation for the suspension of the bladder and the repair of the pelvic aponeurotic diaphragm for the surgical cure of cystocele, I am convinced that it will meet with the approval of those who adopt it in instances indicated. The technique herein described is simpler and easier of performance than the Vineberg, Watkins, Schauta, Wertheim or other modifications of the vaginal fixation of the uterus as a cure for cystocele. Among the advantages of the intra-abdominal operation over those just mentioned is that it is applicable alike to the childbearing and the post-climateric periods. It does not depend on hysterotomy or hysteropexy for success, nor for the resection of the tubes to produce sterility. It contemplates the restoration of the pelvic aponeurotic diaphragm, elevation of the bladder at a higher level on the uterus and suspension of the bladder and uterus through their ligamentary supports, retaining a degree of motility commensurate with the functions of the reproductive organs and leaving the reconstructed pelvic visceral positions as nearly anatomically correct as possible. Like other operations done to remedy this sliding hernia of the bladder, it requires the repair of the torn perineum and no perineorrhaphy is recognized except that which approximates the divided levator ani muscles. It is apparent that this operation may be performed in addition to other pelvic or abdominal surgery which may be required with but little additional time — since it is not tedious in its technique.

Description of operation. The dotted line in Fig. 1 shows the extent of separation of bladder from uterus and anterior vaginal wall. After incising transversely the vesico-uterine peritoneal fold as in Fig. 2, separation of the bladder by blunt dissection from the uterus completely and from the upper inch or more of the anterior vaginal wall is done, so that the bladder (being thoroughly mobilized) may be lifted well up and forward from these attachments. The round ligaments on each side are caught, united, and attached to the most dependent part of the vesicovaginal denudation, with a linen suture passed well into the anterior vaginal wall, as shown in Fig. 3. Another suture or series of sutures of linen approximates the frayed or torn ends of the vesico-uterine ligaments and attaches them to the anterior and upper cervical portions of the uterus as represented by the untied suture in Fig. 3. By letting the needle bite be far out laterally to include the ends of the vesico-uterine ligaments, a narrowing of the anterior vaginal wall in its long axis occurs. The slack is also taken up in the relaxed pelvic aponeurotic diaphragm. Added to this restoration is the support of the round ligament folds. If these ligaments are attenuated and there is still a doubt that the relaxation and decensus will not be overcome by these supports, then artery forceps may be forced through the broad ligaments about on a line with the internal os laterally so that the forceps will catch in the bite the loose folds of the sacro-uterine ligaments and pull them through. The ends of these ligaments are then sutured together with linen and these ends in turn sutured to the denudation on the upper cervical portion of the uterus, serving to pull upward and backward the cervix uteri, and to take up the slack in the relaxed sacro-uterine folds. Successive tiers of chromic catgut sutures are placed so as to approximate the bladder on the uterus at a much higher level than its former normal attachment. Before this suture line is completed, it will be found easier to plicate with

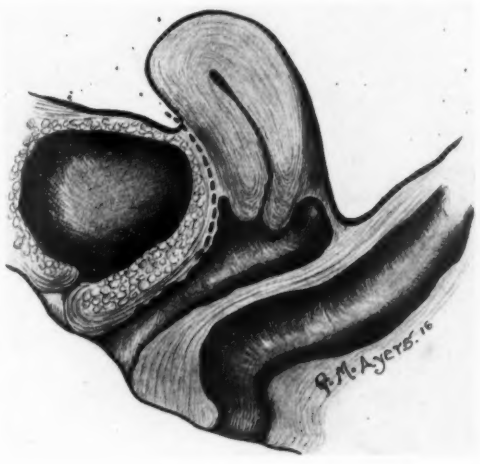

Fig. 1.

Fig. 2.

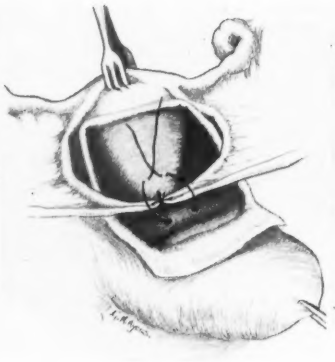

Fig. 3.

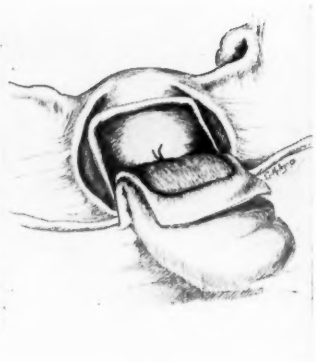

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

linen the round ligaments on each side — including in suture the wall of the uterus laterally and the incised edge of the broad ligament peritoneum, as incorrectly shown in Fig. 5. This (running) fine linen or silk-suture continues until the plicated round ligament approximates its original attachment into the uterus, restoring its original point of traction on the fundus uteri. One or more catgut sutures are placed between the uterus and bladder until the former reflection of the bladder is raised to the fundus and attached by a running suture (of catgut in the fertile linen in the sterile) along a line running above the uterine insertion of the round ligaments. The operation is completed by a continuous suture turning in and approximating the peritoneal edges of the bladder laterally to the broad ligaments and to the fundus of the uterus above.

THE MANAGEMENT OF ADVANCED CASES OF TUBERCULOSIS OF THE HIP

By CHARLES S. VENABLE, M.D., F.A.C.S., San Antonio, Texas

UNDER the title I have selected I refer to those cases which have advanced beyond hope of recovery without radical interference, not only instituted to save the limb but also the life of the patient. Fortunately, as time progresses these cases become fewer, because earlier recognition and the necessity of exactness and thoroughness in treatment is becoming known by the laity as well as appreciated by the profession.

These cases when recognized as a tubercular epiphysitis can and should be cured as such; the ones which have advanced to extra or intra-articular abscesses should be stopped at this and if ankylosis is to follow this should be with the least deformity. These accomplishments are the rule under safe and careful handling; even when it is a case that is ankylosed in malposition, if the active suppuration and destruction has been controlled, one of the plastic operations may be done with great benefit.

But the type of cases to which I refer are those which have been either inadequately treated or those which, in spite of treatment, have progressed unfavorably until not only are the head and neck of the femur honeycombed by tubercular destruction, but the acetabulum as well is badly involved.

To this add increasing deformity, probably discharging sinuses, constant pain and progressive emaciation, and there looms before us a picture that can only be changed by radical measures. This patient is going steadily down hill; his miserable life may be dragged out a year or so, but then he will die. So does it not seem that whatever we do that gives any hope of betterment is better than watchfully waiting for the inevitable?

Removal of the nidus, excision, is the only road left open, and this radically performed before it is too late is what I wish to advocate. On the extent of excision is dependent the end-results, first, of saving the patient, and second,

Fig. 1. Case O. P., tuberculosis of right hip. Head partly absorbed. Neck and trochanter involved. Acetabulum involved. Operation—resection of the head and neck and upper segment of the acetabulum.

Fig. 2. Case O. P. Ten months after operation. Weight-bearing limb.

Fig. 3. Case V. W. Tuberculosis of head and rim of acetabulum — not abscessed. On operation neck and trochanter found badly involved.

of saving any usefulness of the limb. The latter is to be sacrificed in the interest of the former.

It is impossible before thorough exposure to know how extensive this excision must be. A roentgenogram is the greatest aid, but that is not infallible and the true reading is often impossible. By some of the roentgenograms I have of the cases I am to report, you will see that I did more than the picture would seem to indicate was necessary. The guide must be the extent of carious bone, and this must be removed else we do not accomplish our primary object, certainly not so promptly.

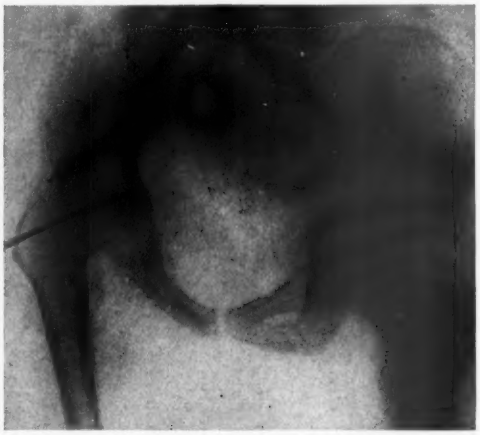

Fig. 5. Case J. A. Resection, head. Neck placed in acetabulum nailed for fixation.

Fig. 4. Case J. A. Tuberculosis and abscess of right hip with multiple sinuses. Ankylosed in extreme adduction. Involvement head.

Then one must determine what manner of joint is to be striven for; whether for a bony ankylosis at the site of the joint or a flail joint that is non-weight supporting or a partially flail joint that is weight supporting. The latter is of course the best as it gives the patient a useful though shortened limb.

Let me pass briefly over the steps of the operation as I think the individual case will bring out more clearly the points I wish to call to your particular attention. Thorough exposure is secured through a Knocker incision, and pus if present is evacuated. The condition of the trochanter is first inspected and if there seems any chance to save this we are in the best possible position to get a weight-bearing limb, provided the upper rim of the acetabulum is not too greatly destroyed, so that the two may be wedged together. Next expose the neck and incise its periosteum so that the bone can be examined definitely and the excision begun just proximal to the carious part. I determine this when in any doubt by driving a nail in the bone and am guided by the resistance and appearances on withdrawing the nail; a nail can be pushed into bad bone and on withdrawing is followed by a small amount of very thin seropurulent fluid. Just proximal to this point the bone is severed with chisel and mallet or gigli saw and the head enucleated. The acetabular rim is then examined and diseased parts carefully removed. There then comes the question of "matching up" that which is left and this is done on a basis of the broadest bony apposition that can be maintained. I do not attempt to close in or repair the capsule as a new one will form, but simply place the new

Fig. 6. Case O. S. Left hip — destruction head. Involvement of acetabulum, neck, and trochanter. Ankylosed in extreme abduction and outward rotation.

surfaces together in what will be the most usefu position and after providing drainage if necessary, close the muscles and skin, all the while having the leg held in this position till it can be so fixed in plaster.

The after-care is rest in bed in the open, day and night, direct exposure of the nude body to the sun when possible, nourishing diet and a moderately occupied mind. I have not found tuberculin of value in these cases and it may be very harmful. Lime salts, etc., while theoretically of advantage, have not proved of aid in my hands.

This treatment is continued for several weeks after complete cessation of drainage and until the general condition of the patient is decidedly improved; that is, until the patient eats well, has no pain or tender points, is cheerful and gaining perceptibly in weight. Then a protective brace is applied and the patient passes to the ambulatory stage. To those in whom I expect any ankylosed joint I apply a Thomas splint and keep them in bed a longer time; I also apply a Thomas splint to those with a non-weight bearing hip as the continued rest is essential to ultimate cure. To those who have a joint consisting of neck and trochanter against acetabular rim, I adjust a splint in which extension is begun immediately after the operation.

The series consists of eight cases. The longest time there has been drainage or sinus discharge has been 13 weeks and the shortest 5½ weeks.

Fig. 7. Case O. S. Three months after resection of head and neck and part of great trochanter. Remains of trochanter resting against acetabular rim. Wound healed, single sinus discharge over trochanter, segment straight.

The greatest period in bed was 23 weeks and the shortest 11 weeks. The periods of non-recurrence have extended over 4½ years in the longest and 2 years in the shortest. Two cases now in the hospital are not included as being too recent for report.

Of the former, one case became active 7 months after discharge, the site abscessed, further interference was refused, and death occured five months later. A second case showed activity about 6 weeks after leaving the hospital, but he re-entered and remained 14 weeks, when the process cleared up promptly, and the patient has remained well a year and four months to this time.

The first of the advanced cases with bony destruction is Case 2 of this series.

This man O. P., 41 years old, was referred to me in May 1911. He had suffered with a tubercular hip in childhood, but had secured a bony ankylosis with some two inches of shortening. In 1909 the process began again, diagnosed as rheumatism even in the face of the

Fig. 8. Case W. S. Advanced tuberculosis of right hip. Involvement of acetabulum-head, neck trochanter. Ankylosed. Note extreme adduction.

former history, and was treated as such until all funds were gone and he became a county charge.

The roentgenogram shows the extensive destruction of the head and acetabulum. In this case excision was a matter of expediency, the shortest cut to make him self-supporting; but even had the conservative method of fixation and rest been attempted, in all probability he would have gone progressively down hill.

He was operated upon in June, 1911; the neck and trochanter were severed obliquely, the acetabulum reamed clean, the bony surfaces placed together and the limb fixed in plaster. You will notice from the roentgenogram that the neck looks very good, yet it was very bad. He was discharged from the hospital in November, 1911, wearing a Thomas splint; the succeeding year he earned his living selling papers and is now night watchman. He has a bony ankylosis and can bear his weight on that leg. His drain site closed about eight weeks after operation, but had the wound been closed there would have been no sinus.

I do not drain this class of cases now.

Case 4, V. W., a little girl 5 years old was seen by me in December, 1911, and had been treated for two years intermittently by several men. This was not the fault of her physician, but of her parents in switching from pillar to post with progressively disastrous results to the child. I kept this child in the hospital nearly a year and on discharge in an extension splint, felt she was doing very well. The roentgenogram made at this time, October, 1912, shows partial destruction of the head and upper rim of the acetabulum, but no active degeneration which bore out the clinical picture. However, the following June she was brought back with every evidence of very active disease; the remains of the head had passed beyond the acetabular rim. I felt that the possibility of control was most questionable, owing to environment, headstrong parents, etc., and that should ankylosis occur at this site deformity would be greater than should I excise the head and replace the neck in the acetabulum. In this case I was misled by the roentgenogram into talking too much. I described too concisely what I proposed to do and so when I came to do it and found the entire neck and trochanter carious, even though I sent for the parent and showed it

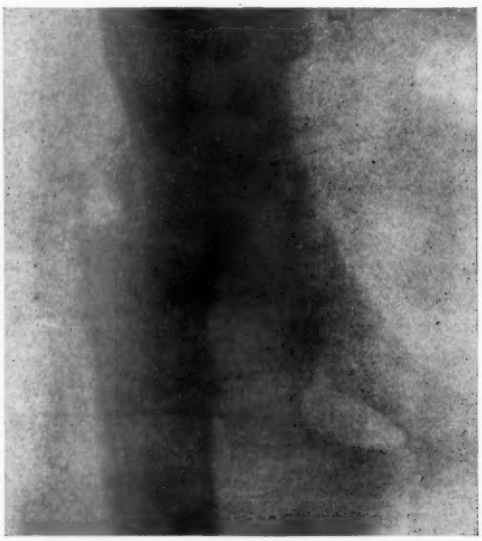

Fig. 9. Case W. S. Eleven months after resection, head, neck and trochanter and acetabulum reamed. Shaft in remains of acetabulum ankylosed in corrected position.

to him, I was not permitted to excise more than the remains of the head. This bad neck was replaced in the acetabulum and the wound closed with protective drainage, but the child never did well and was taken from the hospital in about three months. Her sinus had closed but her condition was poor. About four months later the site actively abscessed, further interference was refused and the child died.

The good lesson taught by this case is that interference must be thorough to be effective.

Case 6 is that of J. A., a colored boy, 10 years old. He was admitted in February, 1914. His history was of hip disease beginning 3 years before, abscessing a year later, since which there have been multiple sinuses and increasing deformity. There was fibrous ankylosis in adduction, inward rotation and semiflexion with marked atrophy of the limb. His roentgenogram is particularly interesting in two ways; it shows the progressive destruction of the head without acetabular disease and the futility of ever reaching the disease in this case with bismuth paste; the bismuth showing in the picture was forced in with a good deal of pressure and you see it only goes to the trochanter.

Unless a roentgenogram shows that the bismuth goes to the spot, it is a useless waste of time to try to make a diagnosis with it.

I resected the head and nailed the remaining neck into the acetabulum as shown in the second picture of this case, hoping to secure bony ankylosis with the limb in the most useful position. The wound was closed without drainage but a drain site was established in about ten days, which closed in about 5 weeks. He left the hospital

in May and now goes about on crutches wearing a Thomas splint. His general health is good, he has no pain and there is no tenderness. When his present ankylosis becomes bony he will have a weight bearing limb. The nail was used to insure fixation.

CASE 7, O. S., a boy 18 years old was brought to me in July last, through the courtesy of Dr. A. S. McDaniel. The history as given by his father was that he had been taken with rheumatism in the hip about three years before—that he had spent most of the time in bed because of pain till it broke about a year ago, after which the pain was less but they couldn't stop it from running, and that was what he wanted now. The boy was greatly emaciated and could hardly walk on account of the extreme deformity. The thigh was ankylosed in extreme outward rotation, there was abduction and semi-flexion with the knee-flexed and fixed. The roentgenogram shows almost total destruction of the head and trochanter and active disease of the acetabulum. It also again shows the limited possibility of bismuth injections. The tract goes only to the edge of the trochanter while the sinus was discharging an ounce of pus or more daily and on operation a half pint or more of pus was evacuated. In this case the neck was severed obliquely just beyond the trochanter which was removed in its long axis and the notch thus formed placed against the upper rim. This case was drained and the sinus closed in 10 weeks. The second roentgenogram was made two weeks after the sinus had closed and shows a very healthy condition of the acetabulum, but still a very questionable condition about the remains of the trochanter. His leg is straight and he has gained 19 pounds to October 17 when he left the hospital. He was kept in an extension splint and on December 10 I received a report from his father that he had gained an additional 11 pounds. Of course, it is a case so recent that I must not be too optimistic, yet I have every hope that this boy is going to be eventually cured. The photograph was taken in August, 1915. He has gained a total of 37 pounds in 14 months.

The last case I shall report is one of a boy 11 years old, W. S., who was brought to me last September. His trouble began with an osteomyelitis of the right femur in October, 1913, which was drained. Then in December it abscessed and was drained, which sinus did not close. Other sinuses appeared and as he was not kept in extension his hip became ankylosed in extreme adduction and flexion.

The first roentgenogram shows this very plainly. He was, of course, emaciated and running a constant temperature. After rest in bed for a month, I removed this head, neck and great trochanter and the upper segment of the acetabulum and placed the end of the shaft against the remaining rim, applying a cast with the limb in the corrected position. The second roentgenogram of this case was taken 11 months after his operation and shows a remarkably healthy appearance of the bones. He now has a fibrous ankylosis in this position. His sinuses have long since closed. He has gained 27 pounds and goes to school. Of course, he still wears a fixation splint (Thomas) and is limited in his exercise. He will be well by this time next year and though his leg will be shortened about 3 inches it will be weight-bearing and usable.

In conclusion permit me to say that primarily I did not select this subject to encourage the drastic procedure described, but rather to emphasize the fact that it is unfortunate that such a procedure has ever to be undertaken. I hope that as time goes on fewer cases will be seen who have reached this pitiable plight.

PUBIOTOMY IN IMPACTED FACE PRESENTATIONS[1]

BY PAUL TITUS, M.D., PITTSBURGH
Obstetrician to the St. Margaret Memorial and Pittsburgh Hospitals

FACE presentation with rotation of the chin into the hollow of the sacrum is quite generally held to be impossible of spontaneous delivery. Every medical student seems to be familiar with this idea, in spite of the rarity of the occurrence, and the majority of textbooks advise craniotomy for this complication no matter how good the condition of the child may be.

Face presentation is seen about four times in a thousand cases of labor (1), and in only about 1 per cent of all face presentations does anterior rotation of the chin fail to take place (2) if given time enough or if given some assistance.

Several methods of treatment have been outlined for the management of these cases, the usefulness of which depends upon the stage at which the condition is diagnosed and its cause. The causes of face presentation will not be considered here further than to say that a moderate degree of pelvic contraction or disproportion on account of a large fœtal head, and certain malpositions of the uterus constitute the commoner etiologic factors. If seen and recognized early enough, the treatment should be directed toward converting this unfavorable position into one more nearly normal, and due attention should be paid to the causative factor in each individual case.

When the face has not engaged too firmly it may be dislodged, and it has been recommended that attempts be made with the maneuvers of Baudelocque and Schatz, which have for their object the conversion of a face into a vertex presentation. These are not of much practical

[1] Read before the Pittsburgh Academy of Medicine, March 7, 1916.

Fig. 1. Roentgenogram taken day patient was discharged from the hospital. There is some enlargement of the pelvic girdle.

value, however, for although the vertex frequently can be brought over the brim, it is rarely possible to maintain this position. The face presentation is the stable one and tends to recur. This is especially true if labor has well started, if the lower uterine segment has formed, or if the face has begun to mold into the pelvic brim. Internal podalic version is often of greater value than either of these maneuvers and should be done unless directly contra-indicated by reason of long-ruptured membranes, etc.

When seen late, however, and a right or left mentoposterior presentation has rotated into the hollow of the sacrum the face becomes impacted and spontaneous rectification is practically impossible. Spontaneous or even forceps delivery is likewise impossible, unless the head is small or the pelvic outlet very large, because of the mechanics involved in the relation of the child's head to the maternal pelvis and its axis. With such a state of affairs existing and the child either dead or in desperate condition, craniotomy is an easy solution of the problem, but with the mother and child in good condition one is inclined to wonder at the lightness with which many authors dismiss the subject by still advising craniotomy.

In discussing this subject DeLee (3) and Hirst (4) barely mention pubiotomy as an operation which has been recommended for this malpresentation both seeming to prefer cæsarean section. Berkeley and Bonney (5) favor perforation although they notice that pubiotomy has been done for the complication in question. Edgar (6) and Cragin (7) do not mention it at all nor does Bumm (8) in this connection although he strongly approves of pubiotomy as an operation.

Many writers seem to look with considerable misgiving upon the operation of pubiotomy done under any circumstances, although their conclusions have apparently been drawn from very different lines of reasoning. One writer, Kreutzmann (9), says that pubiotomy has been avoided in his clientele *from fear of damage suits in case of failure*. Schroeder (10) says that craniotomy should be performed on the living child rather than subject the mother to a serious obstetrical operation, which in many cases will decrease her working capacity and at best is doubtful in its results. By the statement "perform craniotomy rather than a serious operation" Schroeder is implying the opinion that craniotomy is a simple and safe procedure. This idea is utterly erroneous and should be dispelled. Davis (11) in a report of the New York Lying-In Hospital in which he covers a period of twenty years finds a maternal mortality of 15.5 per cent in craniotomies.

Schlaefli (12) has compiled and reported 510 pubiotomies in which there was a maternal mortality of 4.96 per cent and 9.18 per cent fœtal mortality while Roemer (13) who analyzed 300 cases done since the appearance of Schlaefli's article found the maternal mortality reduced to 2.66 per cent and the fœtal mortality lowered to 5 per cent. Averaging the two sets of figures gives us, in a series of 810 pubiotomies, a maternal mortality of 3.81 per cent and a fœtal mortality of 7.09 per cent, which certainly compares favorably with 15.5 per cent of deaths among the mothers and 100 per cent fœtal mortality found after the operation of craniotomy.

Individual operators report even better results from pubiotomy. In a series of 36 pubiotomies in Menge's (14) clinic in Heidelberg excellent results were obtained for all the mothers and only one child was lost, the indication for interference in that case being incorrectly established. Williams (15) and his assistants have done pubiotomy successfully at Johns Hopkins 43 times on 40 patients, three women having been operated upon twice. In discussing Schlaefli's statistics, Williams (16) makes the comment that they do not represent correctly the safety of the operation inasmuch as they are based upon the results of 142 different operators, whereas his own experi-

ence and study lead him to believe that the maternal mortality should not exceed 1 or 2 per cent. Doederlein's (17) opinion coincides with that of Williams in this respect.

In speaking of the indications for pubiotomy, Reed (18) says:. "They must be broadened to include malpositions of the head in normal pelves, such as brow and face . . . . be the chin anterior or posterior, if delivery does not occur in a reasonable time, the condition of the mother and babe being always the criterion." He says further: "Failure to obtain room for delivery after dividing the bones is due to a lack of judgment in choosing the method of operating. Injuries to the urethra or bladder are generally due to bungling technique or operative incompetence. It is probable that the improper and injudicious use of low forceps results in a larger percentage of injuries and more serious traumatisms than occur in hebosteotomy."

Indeed, the criticisms of pubiotomy as an operation come in many cases from those who naïvely admit no experience with it. Davis (19) says: "I have seen it done (I have not done it myself) and the results to my mind are far from alluring," and Poucher (20), while admitting no personal experience with pubiotomy, bases a criticism on the existence of vesicovaginal fistulæ and lacerations of the cervix and perineum in two patients he saw at some time subsequent to their operations. He says further that it "is not to be classed with the clean-cut abdominal section which, when carried out with proper technique, leaves behind it no bad results to the mother or the child." It might be pointed out, however, that under similar circumstances the mortality from pubiotomy is actually lower than that following cæsarean section and that cæsarean section does leave behind bad results to the mother in the form of a uterine scar, which is usually so dangerously weak that she must needs have her section repeated at each labor for that reason if for no other. Pubiotomy on the other hand frequently gives enough permanent enlargement of the pelvis to permit a spontaneous delivery in subsequent pregnancies.

Miller (21) makes the statement "Craniotomy . . . . has no place in obstetrics except when the fœtus is dead or when the traumatism has been so severe that a living child cannot be secured," and in another article (22) as recently as 1915 the same writer gives impacted face presentation as an indication for cæsarean section. But the prognosis after cæsarean section becomes worse in direct proportion to the length of time the woman has been in labor and the number of examinations and attempts at treatment she has had. The mere rupture of the membranes, in fact, increases the maternal mortality considerably. In addition to these factors it would be undesirable in the extreme to drag a presenting part which has been so deeply engaged as to become impacted up from the pelvis and out through the uterine wound of a cæsarean section.

Pubiotomy, as an operation, has been enthusiastically supported by many and as bitterly assailed by others. A careful survey of the situation would seem to indicate that it has a definite field in obstetrics, since in the hands of men who properly understand its limitations, it has met with almost uniform success. Bad results from pubiotomy are the fault of the operator rather than of the operation. Rongy (23) has aptly summarized the relation between cæsarean section and pubiotomy by the following: "Cæsarean section and pubiotomy never compete. In cases where cæsarean section is indicated, pubiotomy is contra-indicated, and vice versa."

Face presentation with posterior rotation offers an indication for pubiotomy that is as definite as any for which the operation is done. It is well understood that the existing disproportion must not be too great lest by the extreme spreading of the cut ends of the pubic bone the sacro-iliac joints become injured. Pelvic measurements alone might be misleading, but the very fact that the presenting head had engaged so deeply that posterior rotation of the chin and impaction have occurred is proof that the disproportion between the head and the pelvic inlet is moderate or "border-line" rather than absolute. One might almost proceed to do a pubiotomy with no other assurance that it is not contra-indicated so far as the degree of contraction of the inlet is concerned, it being necessary then to consider only the size of the outlet.

The work on this subject up to 1912 has been ably compiled by A. H. Morse (24), who collected from the literature four cases of pubiotomy done for face presentation with the chin posterior and added one of his own.

The first case was that of E. B. Montgomery (25) of Quincy, Illinois, who in 1903 attempted to perform a symphyseotomy for impacted mentum posterior face presentation but inadvertently severed the bone at one side of the mid-line while using a saw on what he supposed to be the ossified symphysis pubis. Kannegiesser (26) in a series of twenty-one pubiotomies reported the second case done for this indication, while the third and fourth cases were described by Pankow (27).

Of these cases the first, the second, and the

fourth apparently offer a criticism of the operation, since the infants were lost. Morse, after reviewing the cases in detail, points out that "Montgomery's would have had a happier outcome had the child been in better condition at the beginning of the operation. In Kannegiesser's case, with an estimated true conjugate of 7.25 centimeters, the extraction of a normal-sized child presenting favorably would have been difficult, even after pubiotomy." This head, however, was pressed down at the inlet, not into it, in a face presentation. A contraction ring had formed, so that longer delay was out of the question. Forceps being excluded on account of the high position of the head and the presentation, podalic version was likewise not to be considered because of the fact that the membranes had been ruptured for thirty-five hours. It might be noted that this was really a case for extraperitoneal cæsarean, or Porro cæsarean section.

Pankow's cases were operated upon by open pubiotomy and then allowed to deliver themselves spontaneously. The open wound in such a septic area as is this region offers great chance of infection, whereas the awaiting of spontaneous delivery increases the danger to the child from asphyxiation, and interference may still be required. In Pankow's second case "the fœtal heart became irregular during the wait for spontaneous delivery, and the child died soon after extraction, thus defeating the very object of the operation."

Morse says in summing up these cases: "To condemn pubiotomy because of these unfortunate results to the child would be manifestly unfair. The fact that the lives of the children in these cases were not saved was not due to the operation *per se*, but because in the first case the child was badly asphyxiated, in the second, the operation was contra-indicated, while in the fourth too long a delay was made in awaiting spontaneous delivery."

From the standpoint of the mothers, the procedure was practically harmless with the exception of Pankow's first case in which "there was suppuration of the operation wound followed by streptococcic endometritis and thrombosis of both legs. The patient recovered." The results in Morse's case were excellent.

I have a similar case to report and I find references in the literature to only two other cases; one done by Jacobson, the other by Whitridge Williams.

Jacobson (28) describes a case as follows:

A. R., age 20, admitted February 3, 1910, to Sydenham Hospital. Large primipara in labor about 36 hours. Examination showed a normal-sized pelvis but child presented as a mentoposterior impacted face. Attempts at correction had been made, without success. Child living. The only two methods that could be considered here were craniotomy on the living child and pubiotomy. The open operation was performed. Urine drawn by catheter came away clear and without blood. Nevertheless, the next day urine began to dribble and a vesicovaginal fistula was discovered. Also extensive sloughing of the vagina. This sloughing, caused by prolonged pressure of the fœtal head upon the maternal soft parts, continued for a week. The patient was discharged after a troublesome convalescence, with her baby, her fistula not being quite healed."

Williams (29) in his textbook refers to the other case mentioned, but no detailed report of it has ever been published. Upon inquiry concerning this case, he stated that it was successful in every respect.

The history of my case, which appears to be the eighth pubiotomy done for this indication, follows:

Mrs. B. N., white, English, age 33, VI-para. Of her five preceding deliveries only one had been normal, two being forceps deliveries, one a transverse presentation, delivered after internal podalic version, and the last one a breech presentation. The patient had learned to walk at about thirteen months and was a breast-fed baby. Her menstruation began at 12 to 13 years, the periods occurring irregularly from 28 to 32 days apart. She had had no period between the birth of the last baby and this pregnancy. Family and previous medical history was negative.

Pelvic measurements. Inlet — Interspinal, 26.75 centimeters; intercristal, 28.5 centimeters; bitrochanteric, 32 centimeters; left obliquity, 21.5 centimeters; right obliquity, 22 centimeters; external conjugate, 19 centimeters; diagonal conjugate (measured upon discharge from hospital), 10.75 centimeters; estimated true conjugate, 9 centimeters. *Outlet* — Transverse, 8.5 centimeters; anterior sagittal, 4.5 centimeters; posterior sagittal, 8 centimeters; anteroposterior, 12 centimeters.

Diagnosis: Simple flat pelvis.

The patient was admitted November 26, 1915, to the St. Margaret Memorial Hospital, having been referred by Dr. S. A. Dawson of Treveskyn, Pennsylvania. The membranes had ruptured spontaneously at 12:15 a.m. on the day of her admission, labor pains coming on shortly after. Dr. Dawson had diagnosed a chin posterior face presentation at about 4:30 a.m. and at 6 a.m. attempted to rotate the chin forward by forceps. He was unsuccessful in this attempt and fearing to exert too much traction removed the forceps and brought the patient to the hospital.

Upon admission it was found that the back of the fœtus was to the left, head engaged, with the greater cephalic prominence on the left side. The lower uterine segment was thinned out with a contraction ring about four finger breadths above the symphysis. Fœtal heart sounds were 152 per minute and of good quality. Vaginal examination showed full dilatation of the cervix, a face presentation at about the level of the ischial spines with the chin almost directly posterior. Manual attempts to dislodge and rotate the head failed to make any impression whatsoever on the position because of the firm impaction, and it was likewise impossible to measure the diagonal conjugate.

The depth to which the head had descended and the history of the patient's previous labors seemed to establish

the fact that the disproportion was moderate, and the external pelvic measurements confirmed this opinion. Inasmuch as both mother and child were in good condition, the mother's temperature being 98.6° and her pulse 90, craniotomy was immediately excluded and pubiotomy selected.

The technique of Doederlein's pubiotomy was followed on the right side, this side being chosen because of some large varices in the left labium. The right labium was drawn as far as possible over to the left so that the point of emergence of the needle would be well to the right on the skin surface. The Gigli saw was introduced and the bone easily sawed through, the resulting hæmatoma being controlled with very little trouble by counter-pressure.

Forceps were applied and with the hips firmly supported by an assistant on either side in order to prevent too wide a separation of the cut-ends of the pubic bone, delivery was slowly effected, with the chin still posterior but to the right. The bone-ends separated about 3 centimeters or slightly more. Delivery occurred at 10:45 a.m., ten and one-half hours after the membranes had ruptured and labor had begun, the child, a female, being in blue asphyxia but readily resuscitated although the distortion of its neck interfered with its respiration. The child's weight was 7 pounds, 3 ounces. The placenta was expressed at 11:50 a.m., after closure of the wound over the pubic bone and the puncture of the skin surface to the right of the labium. There was no laceration of the vaginal mucosa and no bladder injury as evidenced by the fact that the urine drawn by catheter was clear. An intra-uterine douche of one-half of 1 per cent lysol solution was given and after adjusting a binder over the hips, the patient was returned to bed.

The puerperium was febrile and this was attributed to the fact that the incision over the pubes broke down and discharged pus for about ten days, quickly healing, however, by granulation. In spite of the fact that local signs did not account for her elevation of temperature, and that there was no evidence of thrombophlebitis, the patient was kept in bed for about three and one-half weeks until finally a definitely increasing area of tuberculosis at the base of the right lung behind was demonstrated.

Upon the patient's discharge from the hospital, January 3, 1916, there was no interference with locomotion except that her "knees felt weak." Examination showed an old relaxation of the perineum and a shallow bilateral laceration of the cervix, the uterus well involuted, in normal anteflexion, movable, no pelvic masses, adnexa free. The pubic bone has a shallow groove on the posterior surface at the site of the operation. Judging from the palpatory findings and the X-ray plate, very kindly taken for me by Dr. G. W. Grier on January 3, 1916, there is some enlargement of the pelvic girdle. Fibrous union after pubiotomy is always the desired result, and although the X-ray was taken too soon after the operation to warrant forming an opinion as to the final outcome, it is interesting to note that it shows no bony union. An examination of the patient on February 9, 1916, disclosed some callous formation and on walking there is a slight degree of mobility at this point. The baby weighed 7 pounds upon discharge, having been fed artificially part of the time in the Hospital on account of the mother's tubercular condition.

All of the cases in which pubiotomy has been done for impacted chin posterior presentations were poor surgical risks. Montgomery's case had been with ruptured membranes for ten hours when interference became necessary. Kannegiesser's case was an improper one for pubiotomy as stated before, because of the position of the head and the degree of pelvic contraction. The membranes had been ruptured thirty-five hours, so that the probability of infection in any more radical an operation was great.

Pankow's first case was infected and had a stormy recovery even after pubiotomy. If the peritoneal cavity had been opened for a cæsarean section she would undoubtedly have been lost, while with even a craniotomy the risk would have been distinctly greater. Her membranes had been ruptured twenty-one hours. In his second case the rupture had occurred twenty-eight hours before operation but an afebrile puerperium followed. Morse's case had been in the hands of a midwife who had made several examinations. The membranes ruptured twenty hours before operation.

As pointed out in the report of Jacobson's case the pressure of the fœtal head upon the maternal soft parts had been so prolonged that extensive sloughing of the vaginal wall resulted. My case had had several examinations and an attempt at forceps delivery in a private home and the head was so deeply engaged in the pelvis as to be impacted. Although the manipulations had been carefully carried out, the chances of a successful outcome to a cæsarean section were poor, or at least the danger of infection was materially increased, and my case was probably one of the most favorable in that respect of those reported.

In this connection, I wish to refer again to the fact that the mortality from cæsarean section in cases of this sort is extremely high, according to Williams (30) "10 or more per cent when the patient has been subjected to a test of the second stage of labor" although otherwise a favorable case. Williams quotes Routh (31) as having noted a death-rate of 2.9 per cent when the operation was performed before rupture of the membranes, 10.8 per cent after their rupture, and 34.3 per cent following repeated examinations or previous attempts at delivery.

In view of these facts, I believe the following conclusions justifiable in cases of mentoposterior face presentation seen after engagement:

1. That a reasonable test of second stage should be allowed the patient in the hope that anterior rotation will take place, either spontaneously or with the assistance of carefully performed manual attempts at rotation.

2. That attempts to rotate by means of forceps are dangerous to both the child and the mother.

3. That cæsarean section is directly contraindicated because of its high mortality in these cases.

4. That craniotomy is the operation of choice if the child is dead or *in extremis*, but that it is by no means as innocuous as is generally assumed.

5. That pubiotomy is the operation to be selected in those cases where the child is alive and in good or even fair condition, and that craniotomy on a living child presenting in this fashion is entirely unjustifiable.

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SURGICAL TREATMENT OF ACUTE EPIDIDYMITIS

By CHARLES MORGAN McKENNA, B.S., M.D., F.A.C.S., Chicago

Assistant Professor in Genito-urinary Surgery, College of Medicine, University of Illinois; Surgeon, St. Joseph's Hospital; Genito-Urinary Surgeon, Municipal Tuberculosis Sanitarium, People's and St. Bernard's Hospitals.

THERE has been much discussion regarding the surgical treatment of acute epididymitis without any definite conclusion. I wish to submit this paper and the results of a limited number of cases, worked out at St. Joseph's Hospital.

Just a word about the anatomy of the epididymis and its surrounding structure. It will be remembered that the epididymis and testes are enclosed in the same sheath, namely, the tunica vaginalis. The nerve supply to these two organs is the same, being derived from the aortic and renal plexus. Upon close dissection, it will be found that the nerve-endings are more superficial in the testes than they are in the epididymis. The area covered by the testes is far greater than that of the epididymis.

Since these are the anatomical findings, we must take into consideration the pressure on the testicle as well as that of the epididymis. In acute epididymitis, we find the beginning of a hydrocele or fluid around the testicle. All the fasciæ between the skin and the tunica vaginalis are upon the greatest tension. The tension is so great that the fasciæ can be heard to make a crackling noise upon dividing them with a scalpel. Gustav Kolischer and the writer demonstrated this on a number of cases two years ago. Hence it is not enough simply to divide the fasciæ and open and drain the epididymis. It is quite necessary to separate the fasciæ one from the other and especially separate the tunica vaginalis from the testicle proper. If the wound is closed at this stage of the operation, the patient

will be greatly relieved of pain, as will be shown later in this paper.

The question always arises whether or not the patient will more likely be impotent if the epididymis is opened. I should always answer in the negative. It will be remembered from the anatomy that the epididymis is nothing short of a canal or tube made up of transverse chambers. After a careful dissection, when the patient is suffering with the above-named pathological condition, the tube stands out very clearly, so that the operator can easily puncture the posterior wall of the affected chamber without doing any injury to the small tubules coming off from the testicle. I wish to mention here that in operating upon a number of cases for short circuit of the vas deferens, the lowest part of the epididymis showed the seminiferous tubules closed, and this part of the epididymis was a hollow tube without any spermatozoa; on further examination, the tubules coming from the testes were blocked. This, of course, was due to the fact that the infection, at the time of the acute condition, was not relieved by operation and nature had to absorb the pus within the lumen. Since the above condition resulted from non-interference, it was my reasoning that the patient would be less apt to become impotent if the pus were drained off before stenosis could take place, as this would leave the tubules and main canal open into the vas deferens.

Many patients who suffer with acute epididymitis and are treated in a palliative way afterward are often capable of passing living spermatozoa. This, of course, is due to the lessened amount of inflammation in the epididymis and the amount of free pus in the vas, which is absorbed by nature at the time of the infection. The only good reason for operating upon this class of cases at all is that the patients suffer excruciating pain at the time, and the character of the pain is indicative of the amount of free pus in the epididymis and the amount of inflammation surrounding the testicle.

Following is the report of 11 cases treated in different ways for the relief of pain. The first 4 cases were treated by cutting down on the epididymis and putting a gutta-percha drain in the lumen. These four cases were greatly relieved of pain, but it was fourteen to twenty-one days before the entire swelling subsided. In 4 cases, the epididymis was exposed by careful dissection and the different fasciæ divided one from the other and the epididymis drained. In these cases, the patients were entirely free from pain and the wound healed and the swelling disappeared within eight days. In two cases, the dissection was made complete, and the fasciæ separated from each other. The epididymis was not punctured for two days. Both cases had immediate relief from general pain, but complained of a sharp toothache-like pain in the testes. In the last case, the incision was made on the opposite side, allowing the free fluid to escape from the tunica vaginalis. In this case, the patient was greatly relieved of pain, but not entirely so. Two days later, with a local anæsthetic, the epididymis was opened and drained and the patient was entirely relieved of pain. It may be well to mention here that doing what is commonly known as a blind-stab operation is not at all to be commended, because it is quite difficult to do this operation and be sure to separate the posterior wall of the epididymis without plunging the knife into the tubules coming off from the testicle on the opposite side. To make a blind stab, even though the patient does get relief, is not satisfactory.

CONCLUSIONS

Surgical interference is necessary only when the patient is suffering excruciating pain. When this procedure is carried out, it is quite necessary to divide the fasciæ so as to free the tension from the testicle as well as from the epididymis. Patients are less apt to be impotent if the posterior wall is divided carefully and the pus drained off than if the pus is left for nature to absorb. A blind-stab operation is that of a faker and should not be considered. It is not enough to expose the epididymis and drain it; all the fasciæ should be free.

It is not necessary to split the epididymis but only the infected chamber which stands out clearly.

THE WIRE GAUZE BRAIN DRAIN[1]

By HARRIS PEYTON MOSHER, M.D., Boston

ONE of the difficult things in the treatment of a brain abscess is to find a drain that does not soon clog and cease to be of use. I suspect that many operators shift about hoping that the last thing which they try will solve the problem. A year ago this June, while working in France with the First Harvard Unit as a member of the British Army Medical Corps, I found that the surgeons there were using a drainage tube which they said gave good results. I tried it once in France and have used it twice since my return. The first case, an extensive gunshot wound of the left frontal lobe, was transferred to England at the end of a week and a half apparently well on the road to recovery. Of the two cases in which I used the drain in this country, one, a cerebellar abscess, recovered, and the other, a case of multiple abscess of the temporosphenoidal lobe (three abscesses in all were found), died at the end of six weeks.

The British Army brain drain is a metal tube closely studded with perforations. In use it is kept filled with glycerine and the gauze over it also is saturated with glycerine. The object of this is to soften the necrotic brain-tissue and to keep the pus liquid so that both the cast-off brain substance and the pus can make their way into the tube. Each day the contents of the tube is removed with a small curette. The first tube which I used was extemporized from a sheet of perforated zinc such as surgeons make emergency splints of. In this country I had the tubes made of copper wire gauze of a fairly wide mesh. In the case which lived six weeks and had three abscesses, there was a chance to experiment with different forms and sizes of the wire drain, so that I feel that I have a pretty accurate knowledge of some of the useful shapes and sizes. These the instrument maker now supplies. In emergency work, however, it is easy to cut a drain from a piece of copper gauze and to fashion it as one wishes.

I am sorry that I do not know who originated the perforated metal drain or who is responsible for the use of glycerine in connection with it. The report about camp was that this form of drainage had markedly lowered the death-rate from brain wounds in the present war. In the rush of army surgery the figures could not be obtained. Undoubtedly some day they will be published.

The attitude which the army surgeon took toward brain injuries interested me, especially as it has a certain bearing on the brain work of the aurist. The wound in the dura was enlarged as little as possible for fear of disturbing any walling off which had taken place between the dura and the pia. The cavity in the brain was probed reluctantly. If there was not much destruction of cerebral substance, no metal drain was inserted. The skin flap, which was generally oval, was turned back into place and a cigarette drain of gauze wrapped in rubber tissue was passed in and out beneath the base of the flap. If the temperature remained normal and no intracranial symptoms developed nothing further was done except to remove the drain after three or four days. If, however, temperature did set in and intracranial symptoms developed, especially choked disk, the wound was opened up and the metal drain placed in the cavity caused by the injury. As I said before, the drain was filled with glycerine and the dressing over it was saturated with it.

In the case which I treated in this manner in France the glycerine was used daily, and Dr. Lougee used it daily in the cerebellar abscess which I saw in consultation with him soon after my return. It was used for a week in the case of multiple abscess of the temporosphenoidal lobe, but was discontinued because I became afraid that the pressure of the glycerine might rupture a weak spot in the abscess capsule.

Now to return to the drain itself. It is difficult to keep the ordinary brain drain in place. The wire drain catches in the granulations at the edge of the skin wound and holds in place almost too well. The copper gauze allows the operator to bend the drain as he pleases. For insertion the drain is closed by a plunger. The natural shape of the drain is a cone. If the drain is kept clean it serves in a measure the purpose of an encephaloscope, as the brain substance or the wall of the abscess can be seen to a certain extent through the meshes of the wire gauze. In the case where there were three abscesses in the temporosphenoidal lobe the second abscess was located by pus welling up through the base of the front wall of the cone. Finally, if brain hernia threatens, counterpressure can be made against the protruding mass by slitting the side of the cone and turning the base back to make a collar. The

[1] Read before the American Otological Society, Washington, May 1916.

wire drain, then, is a pliable instrument. The combined use of this drain and glycerine gives a brain drain which seems to drain. My experience with it is limited to three cases. It is a safe rule to praise slowly and to shun enthusiasm; nevertheless, in speaking of this method of draining a brain abscess I am strongly inclined to break the rule.

A-B-C RULE IN FORCEPS AND VERSION

By S. E. MOORE, M.D., LL.B., Minneapolis
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BEFORE applying the forceps to the cephalic pole, we should run over in our minds, the exact position of the fœtal head as far as we have been able to determine, and the application which we intend to make. This is, metaphorically speaking, applying the forceps "in the air," permitting the instruments to assume outside the body the position which they will occupy when introduced within the vagina. Both the amnion and chorion, the membranes, should, of course, be ruptured.

In a lecture, at which I was present, a medical confrère sagaciously remarked that every pair of obstetrical forceps should have a catheter attached to them. It is a remarkable fact, as evidence of the frailty of the human memory, how often the condition of the bladder is not investigated before the forceps are applied. If it is full of urine, as often happens at the time of operative interference following prolonged attempts at spontaneous delivery, labor will be obstructed. Under these circumstances, if forcible methods are adopted to deliver the child in spite of the full condition of the bladder occasionally unrecognized until too late, rupture of that viscus may occur. Or perhaps a vesico-vaginal fistula following sloughing will result from the continuous and lasting traumatism to which the bladder has been subjected. A rectum full of fæces will likewise offer an obstacle to labor, besides soiling the operative field, when the fæces are ejected from the anus.

The cervix should be completely dilated, or sufficiently so to admit the passage of the fœtus. We should also remember in connection with the portio vaginalis, that both blades of the forceps should be introduced within the cervix, and not outside the os, the latter mistake resulting in the inclusion of the cervix within the embrace of the blades. If the uterus were not ruptured, a severe laceration would certainly follow such a procedure. Once again our memory must not forsake us, for we should remember that the umbilical cord should not be prolapsed and be thus endangered by pressure between the head and the forceps blades.

Frequently it is a good plan, especially in primiparæ, to dilate the vagina manually before applying the forceps, to avoid unnecessary laceration of the perineum. The fœtal head must be engaged in its greatest diameter.

To sum up the situation, for a successful forceps operation, we might conclude that the principal prerequisites are, a proper application of the instruments; ruptured membranes; a practically fully dilated cervix; introduction of the blades within the portio vaginalis; no prolapse of the cord; a manually dilated vagina; and the engagement of the head in its largest diameter.

Mnemonics help some of us, while others derive no assistance from them. I am in the habit of suggesting to students that before applying the forceps to think of the following A-B-C rule, as perhaps it may assist them in remembering the above essential conditions.

A-B-C FOR FORCEPS
(Each Letter Suggests Two Points)

A. Application and amnion. Recalls the application to be made and the rupture of the membranes (amnion and chorion).
B. Bladder and bowels. Suggests the necessary emptying of the bladder and rectum.
C. Cervix and cord. Stimulates the thought in regard to the dilated cervix, and the proper introduction of the blades within the lips of the cervix. Also that the cord is not prolapsed.

(For those students who care to tax their memories further D (dilate vagina) stands for dilatation of the vagina; and E (engagement) suggests the engagement of the fœtal head.)

The following conditions, prerequisites, should exist for a favorable internal version. The application of the proper hand of the operator to

the chosen limb of the child. The membranes should preferably be intact. The bladder and rectum should be emptied, the cervix at least four-fifths dilated, and the cord not prolapsed. The vagina should be previously dilated, and we should never forget during the subsequent delivery to get an assistant through abdominal manipulation to help push the aftercoming head through the brim of the pelvis, at the same time aiding the flexion of the fœtal head by applying the pushing force near the sinciput of the child, which in most cases is directed toward the mother's spine. The cephalic pole, when beginning the version, should not be engaged.

A-B-C RULE FOR VERSION
(Each Letter Suggests Two Points)

A. Application and amnion. Suggests the application of the correct hand to the anterior limb, in most cases, of the child. The membranes (amnion and chorion) should be preferably unruptured.
B. Bladder and bowels. These organs should be emptied.
C. Cervix and cord. The cervix should be at least four-fifths dilated and the cord not prolapsed.
D. (Dilate the vagina and assistant to push down.) Recalls the parenthetical suggestion.
E. (Non-engagement of the head.)

These little rules occurred to me one night after I had failed to empty a bladder in a forceps operation, but happily with no dire results. Since then I have not repeated the misdemeanor.

A NEW TRACTOR FOR PERINEAL PROSTATECTOMY AND A NEW PERINEAL DRAINAGE TUBE

By G. FRANK LYDSTON, M.D., Chicago

SOME years ago I devised a tractor for perineal prostatectomy which, to my mind, solved one of the most perplexing problems of the operation, viz., how to draw the gland down within reach of the operator's fingers and instruments with the least obstruction of the operative field. Since the advent of the Young tractor I have been convinced that my original device has some superior qualities as compared with the Young tractor, which tractor has two very serious faults: First, its beak is set at almost a right angle, necessitating considerable difficulty and severe trauma in its introduction into the bladder via the deformed urethra of the *prostatique*. Second, the "shank" or handle of the instrument is so bulky that it interferes with the fingers and vision of the operator. My original "tractor" (shown in Fig. 1) obviates these faults. It consists of an "arm" or cross piece, resembling in shape a section of an ordinary sound. This is fastened to a heavy wire shank at the end of which is a fixed handle set at right angles. The bladder end of the tractor is fastened to the shaft or shank by a transversely freely movable joint, and is grooved on its convexity so that when closed the shaft lies within the groove. At one end of the tractor-bar is a hole through which a strand of heavy silk is passed and tied for the purpose of removal of the tractor, without necessitating the introduction of the finger into the

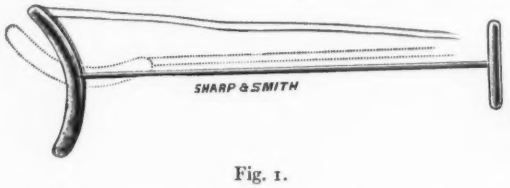

Fig. 1.

Fig. 2.

Fig. 3. Inner tube (above), outer tube, and (below) tube ready for introduction.

bladder, when the operation is completed. The tractor is introduced closed, as readily as is an ordinary sound. After the tractor-bar has been pushed well up into the bladder, to be certain that it is free, traction is made upon the handle, thereby bringing the bar at right angles with the shaft, with the convexity of the bar pressing upon the base of the prostate. The operation completed, the bar of the instrument is pushed upward to the center of the bladder, and by simple traction on the ligature the tractor is withdrawn.

Thinking that more uniform circumferential traction upon the base of the prostate might be an improvement on the foregoing instrument, I devised the tractor shown in Fig. 2, following the general idea of the now practically obsolete Otis urethrometer. This has a double thread screw "expander." The illustration shows the tractor open and closed. A modification of this tractor has a set-screw which, when loosened, permits the instrument to be instantly withdrawn, the blades collapsing immediately traction is made upon the shaft. I have found this tractor very effective.

To forestall an obvious theoretic objection I will state that thus far I have experienced no difficulty with the tissues catching between the blades of the instrument. I have not yet succeeded in devising a practical rubber sheath to obviate such a contingency. In practice, the tractor is easily introduced closed into the bladder, the blades being then expanded with the screw. The tractor now is drawn down until the bases of the blades press upon the base of the prostate, such traction as is necessary being thereafter made during enucleation of the gland.

The perineal drainage tube shown in Fig. 3 was devised to meet what the author has found to be an occasional demand in perineal work, both in prostatectomy and other operations where bladder drainage is required.

It sometimes is desirable to drain simultaneously *per urethram* and perineally, or to drain *per urethram* after removal of the perineal tube. The tube herewith shown is made double, with a groove upon its dorsal or concave surface into which a No. 24 French catheter readily fits. The catheter is first introduced, and then the tube, each being left *in situ* as under ordinary conditions. When the perineal tube is withdrawn the catheter is not disturbed. The tube is made of aluminum, and thus far seems quite practical.

The foregoing has, of course, no bearing on the selection of method. Despite the present popularity of the suprapubic operation, there probably always will be a certain number of cases in which the operator, for one reason or another, will prefer the perineal route.

TECHNIQUE OF EXTERNAL URETHROTOMY

By J. NIEMACK, M.D., Charles City, Iowa

THERE are cases of stricture in the pars bulbosa, requiring an external operation, where even under endoscopic guidance no bougie could be made to pass. It is in these cases that my suggestions will be of value; but even in the average case I have derived some benefit from them.

Preliminaries. The patient must learn to urinate in the position intended for the operation, either knee-chest or lithotomy position. He is given methylen blue and urotropine for at least 24 hours before operation.

The operation is done exclusively under local anæsthesia, liberally injecting the surrounding parts with novocaine and adrenalin. Then a heavy rubber catheter is introduced just as close to the stricture as can be done, and under moderate pressure a drachm of 10 per cent cocaine solution is introduced (stained blue), while the meatus is compressed against the catheter. With an intestinal curved needle the point of the catheter is fixed to the urethra alongside the stricture.

Now the patient is placed in the position required for operation, and with all instruments in readiness and the surgeon seated, the patient is requested to urinate. The urethra above the stricture will at once bulge out and the pointed knife is thrust through close to the narrow spot. In this way the length of the stricture is known beforehand by having the distance between our stitch and the bulging part of the bulbous urethra. One clip with a narrow blunt-pointed scissors will often be sufficient to open the path. Then pull the stitch out and carry the catheter up the rest of the way into the bladder, which can easily be done if two small hooks are lifting up the incised upper urethra.

TRANSACTIONS OF SOCIETIES

AMERICAN COLLEGE OF SURGEONS

ANNUAL MEETING OF THE FELLOWS HELD IN PHILADELPHIA, OCTOBER 27, 1916

The purposes, the actual work, and the plans for the future of the American College of Surgeons were definitely brought out at the recent annual meeting of the Fellows, held in Philadelphia. Only such matters are here included as are of general interest to physicians and surgeons.

George W. Crile was elected President of the College and Chairman of the Board of Regents, to succeed Dr. J. M. T. Finney who had served the College in this capacity since its inception. Rudolph Matas was elected First Vice-president, and Robert G. LeConte Second Vice-president. The Board of Regents as now constituted is composed of George E. Armstrong, Montreal; Herbert S. Birkett, Montreal; George E. Brewer, New York; Frederic J. Cotton, Boston; George W. Crile, Cleveland; J. M. T. Finney, Baltimore; William D. Haggard, Nashville; Edward Martin, Philadelphia; Franklin H. Martin, Chicago; Charles H. Mayo, Rochester; Robert E. McKechnie, Vancouver; Albert J. Ochsner, Chicago; Harry M. Sherman, San Francisco; Frank F. Simpson, Pittsburgh; and Charles F. Stokes, Warwick.

REPORT OF THE DIRECTOR[1]

JOHN G. BOWMAN

Three years ago Sir Rickman Godlee brought to the Fellows of the American College of Surgeons the greetings of the Royal College of Surgeons. On that occasion Sir Rickman said that he would give us ten years in which to get our organization under way. On this occasion it is my privilege to report to you the workings and progress of the third year of that task.

This is our annual meeting. It is a serious occasion on which to pause and to look backward and forward. It is an occasion on which I beg that each of you will hold an annual meeting with yourself as well as with one another; for however perfect the machinery of the College may be, that machinery will never take the place of character, of leadership, and of that something we call affection. Trust, co-operation, and constructive inspiration, are the things which in the end make for success. These are the things which must stir in the hearts of each of us if collectively we are to accomplish great work.

This report now will touch chiefly upon two subjects: First, the admission of Fellows to the College; second, the investigation of hospital conditions.

ADMISSION TO FELLOWSHIP

During the past year about 200 Fellows have been admitted to Fellowship. These 200 Fellows were selected out of about 2500 applications for Fellowship now on file. Of the 200 admitted about one-half submitted case histories as evidence of their qualifications in surgery. We have now enrolled about 3700 Fellows.

Quite beyond the realization of most of the Fellows, the policy of the Regents is to admit only those surgeons who beyond all reasonable doubt are competent and honest. On the other hand, the Regents propose definitely to invite all surgeons to Fellowship who meet these qualifications and to sift away all personal prejudice in making their decisions.

Some details of the process of admitting Fellows may here be of interest. In each state we have a State Credentials Committee of from five to nine members. These committees are elected by the Fellows of their respective states. All applications for Fellowship from a given state are then submitted to the State Credentials Committee concerned. Service on this committee is a serious trust. The committee is asked to pass upon each candidate, having before it not only the data obtained by the central office, but also the data obtained at its own initiative. Each committee is asked, further, to give its reasons for its decisions.

After action has been taken by the State Credentials Committee, the applications are

[1] Stenographic report condensed

then reviewed by the Central Credentials Committee which meets about every other Monday evening at the offices of the College. When a candidate is approved by his State Committee and by the Central Committee, he is then privileged to submit one hundred case histories (as outlined in Bulletin No. 1) as further evidence of his qualifications. But he is not given this privilege unless there is abundant reason to believe that he is qualified.

In the judgment of the Regents these case histories are proving to be a very genuine test of fitness. The histories, when properly recorded, make clear the data on which each diagnosis is based; they make clear the physical findings, gross and microscopic, and the laboratory analyses. The family history and what happened at the operation and the end-results are also important factors.

During the past year about sixty per cent of those who submitted case-histories failed of final approval. This large percentage failed because the histories were incomplete or because the diagnoses were not based on sufficient evidence, or because, having the evidence, the diagnosis indicated lack of good surgical judgment. These failures, however, do not necessarily mean that the candidates are rejected for all time. In some instances, where success was nearly attained, the candidate may try again. In other instances the candidate may try again only after submitting satisfactory evidence of additional preparation for the practice of medicine and surgery. The Committee on Examinations makes a written report upon each case together with its recommendations.

In all of this work comes a large human element which cannot always wisely be subjected to arbitrary rules. Time does not permit now of illustrations. But let me say that the care and fairness with which each case is considered has been to me a constant inspiration. Few of you, I am sure, realize how much effort goes to make up the final decision of the Regents. The Regents know that their trust to you is to make these final decisions right.

INVESTIGATION OF HOSPITAL CONDITIONS

The actual contact of the College, it seems clear now, will come not only with the profession, but also with the general public through our proposed work among hospitals. This work is not merely something which we may do; it is something which we must do. It is our business to know what real training in surgery means. That has been obvious to all of us from the start. And it is a true estimate, I believe, to say that eighty per cent of what a surgeon uses in practice he acquires during his interneship and hospital training. In other words, the particular training ground for the surgeon is the hospital. Forced upon us, then, is the obligation to know what this training ground is, and what kind of a standard we should hold up to ourselves as the proper training of a surgeon in a hospital. Further, the problem of the training of a surgeon in a hospital cannot be isolated as a separate factor of the hospital's program. We cannot say that here the training of the surgeon begins, and that there it ends, for the training of the physician is also largely the training of the surgeon. The problem involves us in the whole question as to what is the proper care of sick people.

There are specific divisions, however, in every hospital which we may investigate, and, having accurate data, we may point the way of progress. For example, what is the condition of the case-histories of a given hospital? Are they complete? Are they accessible for study and future guidance? Are end-results followed up with conscientious common sense? Are summaries of these results made public as evidence of the competence of the physicians and surgeons practicing in the hospitals?

We may ask, further, what the conditions are of the hospital laboratories. Important elements in the training of the surgeon are that he know how to use the laboratory, and that he form a habit of using it. What are the laboratory facilities which a hospital of a given number of beds may reasonably be expected to provide? Are the laboratory findings made a part of the case-histories? Does the pathologist make a permanent report of his exact findings? To whom are such reports made? Do the superintendent and the trustees who are responsible for the government and the administration of the hospital take pains to assure themselves that the work of the laboratories is competent and that reports of findings are fearlessly set down?

This last question leads us to the whole problem of hospital administration. We cannot avoid it. What is the relation of the Board of Trustees to the medical staff? Or to the hospital superintendent? In passing, let me say that it is the business of the superintendent to carry out the directions of the Board of Trustees. He should be told what kind of a staff is privileged to practice medicine and surgery in the hospital. He should see to it, then, that only

men worthy of the hospital's ideal are given this privilege.

There is one superintendent in this country whose ability to meet this difficult problem is an inspiration. His hospital, as it happens, is one of "open staff." This superintendent has not raised any technical questions as to the merit of an "open" or a "closed" staff. To him competence and honesty are fundamental. He has made it his direct business to know what goes on in the operating room, and to know what happens in the particular case before the operation occurs. If a surgeon operates in that hospital without evidence of genuine ability, the superintendent, after the operation is over, quietly puts his hand on the man's shoulder and says, "We do not want you to come back again. Your work is not satisfactory. If you wish to make an issue of this matter, I will meet you. You are privileged to return, however, whenever you will show that you have acquired the training necessary to modern surgery."

The trustees support this man. What is the result? The hospital is still of the "open staff" type, but in practice it is more "closed" than most "closed staff" types. The trustees of this hospital are able to say to the people of their city that their hospital is a genuine guarantee of competent, honest service.

Why shouldn't the trustees of other hospitals be able honestly to guarantee to their communities honest, competent service? Such a condition is one of the things which the American College of Surgeons proposes to bring about. It proposes to deal with these problems in no uncertain or half-hearted fashion. The central part of its effort will be a series of pamphlets written so simply that the man who moves his lips when he reads can understand. These pamphlets will deal one after another with the things which make hospitals the right sort of institutions for the care of sick people. Sometimes it may be necessary to call meetings of the local commercial clubs, or of other bodies of laymen, in order to waken up the community as to the actual conditions in their hospitals. If this course is necessary, it will be followed. The day has gone by when any sort of indifferent or incompetent practice can be shielded in a hospital. The day has gone by when hospital trustees may rest in an irresponsible attitude toward the trust imposed in them.

Again, what is the relation of the hospital to the county or local medical society? Are the facilities of the hospital freely at the service of the society? Is the spirit which dominates the work of the hospital an inspiration? Is it progressive and unselfish? These are merely some of the questions which the College of Surgeons proposes to answer in the fashion already indicated. It is probable that we shall begin with a study of the training of the internes. This problem is most closely related to our needs in the administration of the College. Further, if we go right to the bottom of the problem we shall find that it is really a question of what is the proper care of the patient. A full outline of this problem has already been sent to you.

You are a group of surgeons of more than average ability. You are deeply concerned with the advance of the profession; otherwise you would not be here. You are concerned that the great mass of people should know the right answers to the questions just proposed. In these things and by the very nature of your daily routine you are compelled to be philosophers. The process of thought which tends from anatomy to psychology, and then from psychology to philosophy is forced upon you. Philosophers rule the world. They do this today, and they always have done it. The man of action may not know that this proposition is true. But that is aside from the point. Now there is good philosophy and indifferent or bad philosophy. Of these you must choose. In other words, you must find and express thoughtfully the personal equations of your lives. You must express in terms which we all understand the x and the y of your equations. How will you do it? Are you in the practice of surgery primarily to make money? Are you in it primarily to relieve suffering and to prolong life? Are you in it to lift your community to a plane higher than it would be without you? Can you find your equation in scientific research? Are the inspiration and thrill which come from entering an unexplored field of truth and in finding there something of lasting benefit to humanity—are these things known qualities in your equation?

That you answer such questions is what I meant when I asked you each to hold an annual meeting with yourself. Some time ago, near Nashville, I visited the old home of Andrew Jackson. Jackson, it seems, left a slave by the name of Alfred who outlived him many years. One day Alfred was asked if he "reckoned" that the General went to Heaven. "I dunno, suh," he replied. "He did if he wanted to." That is the sort of philosophy which

stirs me. We can do things if we want to. We can do all that we hope to do if we really want to do it. If the objects of this organization really coincide with the desires deep in our hearts, we can turn our aspirations into facts in spite of any opposition in the world.

Now a word about fee-splitting. This is a subject which I should like to avoid. It is a disgrace that there is need even to mention it. But there is need. Any one who divides fees is a liar and a thief. If milder terms would fit the case, I would use them. They will not fit. This evil is the basis of unnecessary operating and of incompetent operating. The College has plans now to fight it beyond anything yet attempted. But we cannot go into that subject now.

The Board of Regents has just held a meeting. It has just considered the names of seven Fellows of the College about whom there is some evidence of the practice of division of fees. After full consideration, the Board dropped three Fellows from our list. Two of these are suspended pending further information. The Board voted, further, to make public the names of men expelled from Fellowship. (The name of a Fellow was read who was expelled for "reasons derogatory to the dignity of the College and inconsistent with its purposes.")

The work of the past year has developed a most important fact in this connection. A surgeon cannot engage in the division of fees and cover up the practice. The Regents do not propose, either, that the practice shall be covered up. They mean business, and propose to expel any Fellow from our group, however prominent he may be, whenever the facts justify such action.

We need your help, your co-operation, and your constructive inspiration. We need your belief in us; your confidence that nothing crooked is ever to be put over; your confidence that the biggest things that have ever happened in medicine *are* to be put over. When you joined the American College of Surgeons you did not join merely one more medical society. You joined a society which commands that if there is any white light in you, it must burn. It commands that you grasp the day's routine as a social service and in this twilight era that you illuminate those outlines, now only traceable, of the public good will which the profession should merit. It commands that you turn on the light.

REPORT OF THE GENERAL SECRETARY

FRANKLIN H. MARTIN, M.D.

RECAPITULATION

Members of the Board of Regents realized early that they must keep constantly before themselves the fundamental reasons for the existence of the College. They realized that the College was organized to define good surgery; to recognize those who practiced good surgery; to elevate the standard of surgery; and to inspire every man who conscientiously desired to support such a program to ally himself with the movement. Before the organization meeting was over, those present cheered the proposition that "a good surgeon" is more than a man with a practical scientific knowledge of medicine and surgery. A good surgeon, in addition to such qualifications, is a man of honor, of trustworthiness, and of strong moral character.

Straightway in the administration of their trust, the Regents had these questions to answer: (1) What is a genuine standard of good surgery? (2) How may we recognize those who practice good surgery and invite them to ally themselves with the College? (3) By what processes shall we make headway toward better standards of surgery?

It is easy for an exclusive society of eighty or one hundred surgical specialists to define a standard of excellence and arbitrarily to select eighty or one hundred men on the continent who will qualify for membership. Such societies are usually social as well as scientific; and they are of vast benefit to the progress of medicine, for they aid in disturbing old and fixed ideals of attainment. Their object is to cultivate some particular specialty of surgery to its highest excellence. There are already in existence one or two such societies for each branch of surgery that is recognized by the American College of Surgeons.

The American College of Surgeons, in contrast to these societies, is a democratic and inclusive organization. It is not only interested in the advancement of *some* branch of surgery, but of *every* branch of surgery. Its special task is to insist that surgery wherever practiced on this continent shall be under the surveillance of an

organization which is strong enough in its moral reputation, and strong enough in its influence upon society, to render impossible the practice of surgery on the part of men who are not educationally, scientifically, and morally equipped to do the work. Its task is to provide the public with honest, competent service.

The Regents are constantly reminded of the insecure position we occupy in this country as compared to that of the Royal College of Surgeons of England. On the other hand, we realize that our youth finds us unhampered by entrenched restrictions. Our opportunities are unbounded.

The first step forward was, obviously, to determine upon a standard of moral and scientific excellence for admission to Fellowship. Years of experience are essential to anything like a final analysis in this matter. But we know that any right standard must command the respect of the profession at large and the confidence of laymen. Of necessity, we must look into the moral and intellectual soundness of each candidate. This means that we must estimate the value of the candidate's educational opportunities, as determined especially by the medical school from which he graduated. We must estimate the practical hospital training that he received, the assistantship which he served in the art and science of surgery, the value involved in the license which he has acquired to legalize his practice, and his actual performance as an independent practitioner of surgery. Of great importance also is a knowledge of the methods of the hospital and of laboratory environment wherein his work is done.

In this estimate of our candidates' fitness we have been obliged to apply arbitrary rules. The report of our Director, Mr. Bowman, has given you an insight into the more concrete methods that we are employing in the classification and standardization of hospitals; of our educational campaign in conveying the knowledge to the laity; of the pernicious practice of fee-splitting; of the satisfactory working out of the preliminary plan for applying an examination test to our candidates.

Strenuous work upon the part of the Regents, the officials, and for the past eighteen months upon the part of our Director (who has energetically devoted his entire time to our problems), has succeeded in devising methods by which our arbitrary rules have been applied with much success. The result is that nearly four thousand surgeons are today enrolled as Fellows of the College.

But we are face to face with grave problems. Let me enumerate some of them: First, the discrepancies in the standards of efficiency among hospitals in which recognized leaders in surgery do their work. Second, the wide range of difference in surgical training of graduates of medical schools of like classification. Third, the great difference in the surgical training received by internes in hospitals of comparable equipment. Fourth, the confusion in estimating the value of an assistantship to recognized surgeons. Fifth, the lack of a standardized system of case-histories through which we may estimate the merit of work as submitted by candidates to the Committee on Examinations. Sixth, lack of uniformity among graduate courses in surgery as offered by educational institutions which control the great clinical centers.

Conscientious work as an official or a committeeman of the College soon convinces one that there is no concerted action on the part of the medical societies, medical schools, hospitals, or legislatures, in the direction of making safe and experienced surgeons out of medical graduates. Outside of three or four conspicuous exceptions, where a limited number of selected men are thoroughly drilled as surgeons, and where they are turned out as skilled diagnosticians, pathologists, and operators, there is no real training school for surgeons. These super-trained surgeons are so few in number that they cannot fill even the teaching positions in the large centers of population. Now let me ask: Is the standard of surgery of these few men too good for the public in smaller communities? Is the best surgery too good for the humblest patient anywhere in our country?

With our great faculties of medicine, with our endowed laboratories, with our great private and public hospitals, with our foundations of medical research, is there not one force on this continent to say to these leading organizations: "You must not sanction the general practice of surgery to those untrained in surgery"? Is there a force in better position for such leadership than the American College of Surgeons? Can any one doubt that the College, consisting of four thousand real surgeons of America, has any right to shirk such a responsibility? Can the College find the slightest reason to delegate this tremendous task to any other organization? If it is proper that some force should standardize surgery, then it is right that the College should set about the work, for the very preamble of the College insists that the standardization of surgery is our major business.

Our responsibility in this direction is plain. We can meet the responsibility. To start with, practically all of the teachers of surgery on this continent are with us. Through clear aspirations, through genuine enthusiasm, and through untiring efforts we have weathered all waves of criticism and perfected a powerful organization. Further, that organization is now endowed. An inspiring momentum is under way. While this initiative is with us, let us become the keepers of surgery on this continent in a fashion as yet only true in dreams.

I am so thoroughly convinced that this tremendous undertaking should be assumed and directed by the American College of Surgeons that I am going to ask you to create some further machinery needed for the work. Every day that we neglect to provide means to prevent untrained men from operating (except in emergencies) we are a party in encouraging unnecessary and criminally unsafe surgery.

INTERNATIONAL COMMITTEE ON STANDARDS

I propose that here and now, by resolution, we authorize and instruct the Board of Regents to select in each state of the United States and each province of Canada, by a vote of the Fellows of each state and province, a committeeman at large, elected for a period of service of three years. These committeemen, with the members of the Board of Regents, are to be known as the International Committee on Standards of the American College of Surgeons.

This Committee shall meet each year, at some convenient time and place, to discuss ways and means to bring about (a) supplementary and graduate training for surgeons; (b) legislative enactment and other means to prevent dishonest practices; and (c) the enactment of laws that will protect the public against untrained surgeons.

Each year this committee, after careful consideration, shall crystallize its efforts into recommendations, and these recommendations are to be submitted to state committees, hereinafter mentioned, and to the Regents of the College for study, and, as far as possible, for execution.

STATE AND PROVINCIAL COMMITTEES ON STANDARDS

I also propose that the Regents, by a vote of the Fellows in each state, select a committee to be known as the State or Provincial Committee on Standards (of which the International Committeeman of each state or province shall act as Chairman) composed of two Fellows for each million or additional fraction of a million of population. This committee, with its Chairman, shall act as the Committee on Standards in its community and aid in carrying out the recommendations of the general committee of the College, under the guidance of the Director.

These committees, backed by the Fellows of the College, will be in a position to enlist the aid of every progressive medical society, of every medical school, and of every well-equipped hospital, and when the object of their existence is thoroughly understood, the aid of every thinking layman in our two countries.

The two resolutions proposed by Dr. Martin and unanimously approved by the Fellows of the College are as follows:

Be it Resolved, That the Board of Regents be instructed to hold an election of the Fellows of each state and province for the purpose of selecting a committeeman from among their number to act on a General Committee on Standards, to be known as the International Committee on Standards of the American College of Surgeons.

Be it Resolved, That the Board of Regents be instructed to hold an election of the Fellows of each state and province for the purpose of selecting from among their number two committeemen for each 1,000,000 population to act on a state or provincial committee to be known as the state or provincial Committee on Standards of the American College of Surgeons.

CHICAGO GYNECOLOGICAL SOCIETY

JOINT MEETING OF THE CHICAGO SURGICAL SOCIETY AND THE CHICAGO GYNECOLOGICAL SOCIETY, MAY 26, 1916, WITH DR. CHANNING W. BARRETT AND DR. SAMUEL C. PLUMMER PRESIDING

Upon motion duly seconded the discussion of the various papers was deferred until after all of the papers on the program were read.

DIAGNOSIS AND MANAGEMENT OF ACUTE EXTRAPELVIC CONDITIONS DURING PREGNANCY

DR. E. WYLLIS ANDREWS read a paper on "Diagnosis and Management of Acute Extrapelvic Conditions During Pregnancy." (See p. 657.)

THE DIAGNOSIS AND MANAGEMENT OF PREGNANCY IN THE PRESENCE OF ACUTE ABDOMINAL CONDITIONS

DR. JOSEPH B. DELEE read a paper entitled "The Diagnosis and Management of Pregnancy in the Presence of Acute Abdominal Conditions." (See p. 660.)

THE DIAGNOSIS AND MANAGEMENT OF PELVIC AFFECTIONS COMPLICATING PREGNANCY

DR. HENRY F. LEWIS read a paper on "The Diagnosis and Management of Pelvic Affections Complicating Pregnancy." (See p. 663.)

DISCUSSION

DR. CARL BECK: The gentlemen have accomplished the Herculean task of touching upon almost the entire field of surgery in conjunction with pregnancy, and it is very difficult to discuss such a subject. As I sat here several questions went through my mind: first of all, how should an obstetrician behave when brought face to face with a fractured patella, and how should an eye specialist behave in the first stage of labor and so on. I thought I must pick up the latest book on surgery of the obstetrician or the obstetrics of the surgeon. I think it is wonderful how we return again to the beginning of our study of medicine, when we were walking encyclopedias of ignorance in medicine, when we had the whole field of medicine to learn. Gradually, with the increase of our science and the development of our technique and diagnostic methods, we have become so minute in our demands and in the exigencies of our different specialties, that it is now really very hard to be satisfied.

It is a great service that the Gynecological Society has done the surgeons in inviting them to discuss these common subjects. I hope that sooner or later we will unite with the dermatologists and the pathologists and the eye specialists in one common society and discuss medicine on a common ground.

Several points ought to be discussed a little more in detail, because they are of practical importance. There is the treatment in abdominal conditions, like gall-stones, extra-uterine pregnancy and appendicitis and certain kidney troubles. Appendicitis is the most interesting and important. Appendicitis and pregnancy may frequently occur together. How should it be treated? The obstetrician knows how it should be treated, but the ordinary midwife or practitioner does not know, and he mistakes very often the pains of appendicitis for the symptoms of the coexisting pregnancy; that is, he does not make a diagnosis of appendicitis. The diagnosis should be made early; of course if it can be made before the pregnancy so much the better, but if it cannot be made, and it is often not made until the pregnancy occurs, it should be operated upon, no matter at what stage of the pregnancy the appendicitis occurs. There is another point. It should be a total radical removal of the appendix. I do not think there is a surgeon now living who does not make the radical removal in appendicitis, even with the existence of an abscess because it really does not differ very much in the outcome. The radical removal is the usual treatment of appendicitis in pregnancy.

There is the extra-uterine pregnancy and the normal pregnancy, and the differential diagnosis is interesting, but there is the possibility of a regular normal pregnancy and an extra-uterine pregnancy coexisting. I have observed this on two occasions. So that the diagnosis is the important part inasmuch as the surgical technique is universally accepted; the diagnosis and the necessary indications are the most important part; and I think we all agree more or less with these sentiments and thoughts that the essayists have brought forward.

One point I would like to mention and that is the very important feature which I hope somebody else will discuss, which Dr. Andrews brought out, the coexistence of internal secretions and abnormalities of secretions in pregnancy, which touches upon a field of medicine very far from that of the ordinary surgeon; but we have to practice general medicine and surgery at the same time.

DR. C. S. BACON: I can fortunately discuss Dr. DeLee's paper in a very few words, because I agree with practically everything he has said. His discussion of the differential diagnosis between extra-uterine pregnancy and other abdominal conditions is so clear and complete that nothing need be added to it.

There is only one point that I would make, and that is in regard to the treatment of chronic appen-

dicitis during pregnancy. As I understood him, in the case of an acute appendicitis coming on first during pregnancy, of course, operate. In the case of an old appendicitis he would not operate unless the symptoms become acute. That I think is one of the most important questions that we have to consider, and I would like to illustrate the difficulty by reporting a case. A woman, who had had two or three attacks of appendicitis, in which she had suffered considerable pain, became pregnant and went through a fairly easy pregnancy. There were no symptoms of acute appendicitis, but always some trouble in the region of the appendix. After a labor which was not very difficult, she had acute appendicitis which came very near proving fatal. Later she was operated on for appendicitis, a very difficult operation. It has always been a question in my mind whether the risk of the puerperal appendicitis could have been avoided if the operation had been done during the pregnancy as soon as symptoms of the appendiceal trouble arose. I think that is one of the very difficult questions which we have to decide: shall old cases of appendicitis be operated upon if discovered during pregnancy? Can we thus avoid the dangers which in a very large proportion of the cases will arise during labor and in the puerperium?

The question of pyelitis or pyelo-ureteritis has been discussed so recently in this society, in its meeting with the Urological Society, that it is fresh in the minds of the members of the Gynecological Society. In that discussion the general opinion was expressed that abortion should not be performed for this condition, although we know that generally recovery occurs after the emptying of the uterus. That makes this trouble quite distinct from that of appendicitis, where of course the emptying of the uterus does not cure the appendicitis. We might think, because it will cure the pyelitis, that the emptying of the uterus should be tried. I confess that while I have never seen a case where it seemed to be necessary to empty the uterus, I feel that in a severe case I should prefer to do that to removing the kidney or to any serious operation on the kidney.

I will take the minute that remains in speaking about a question which comes up in connection with Dr. Lewis' paper, the management of retrodisplacement of the uterus. I believe that we can practically always by manipulation, sometimes by tampon and also by the use of the air-bag, either in the vagina or in the rectum, or perhaps the mercury-bag in the vagina, bring the uterus out of the pelvis. I have succeeded several times in doing this with help of the bag where simple manipulation did not suffice. It seems to me hardly likely that any condition would arise where opening the abdomen would be necessary for the displacement.

DR. STOWE: Ordinarily in about 15 or 16 per cent of cases after labor we find retroversion of the uterus. This frequently is temporary, but in some cases in which we have adhesions or inflammation occurring, it becomes more or less permanent. If pregnancy occurs in a retroverted uterus, it all depends upon the presence or absence of adhesions as to what is our method of treatment. In the early weeks of pregnancy the uterus can be raised easily with the fingers and retained with a pessary, and this is the method of procedure as long as we do not inflict too much trauma on the uterus. Ordinarily the patient comes to us complaining of urinary disturbances. That is the first clue that the patient has that something is wrong. If every woman who comes in with urinary disturbance is examined we will see in many of these cases an incarcerated retroverted gravid uterus early. At this time, if we push up on the fundus and lift the cervix of the uterus away from the bladder, the bladder will partially empty itself; another good sign which we have of this condition.

In the early stages of this condition, therefore, we can use manual reposition as long as we do not use too much force. If, however, the case is in the early stage, and the condition is not very threatening one can use the colpeurynter in the vagina and exert a less forceful but more constant upward pressure on the uterus. This may be worn from four to six days. If the bladder becomes infected, then we have to think of emptying the uterus. As soon as we have a colon bacillus infection of the bladder and a foul urine, and necrosed threads of mucosa are expelled, we have to pay attention to the uterus, and empty the same by posterior vaginal cæsarean section. As soon as we have any infection of the bladder, laparotomy should be out of the question until the uterus is emptied.

Regarding treatment of salpingitis, I have unfortunately seen two cases of rupture of the ordinary pus tube in pregnancy. One occurred about four years ago, in which the patient was very toxic, and had a diagnosis made of an appendicitis. She was operated on by a surgeon and the appendix was found normal. There was severe pain on pressure over the area of the appendix. As the patient was six or seven months pregnant the diagnosis was difficult. The operation showed a normal appendix. Three days later the patient began to suffer from general peritonitis. It was found she had a left pus tube, and the pressure that had been elicited by the hand over the appendiceal region caused her pain which had been transmitted toward the pus tube. This pus tube had ruptured, and the second operation was indicated because of the general peritonitis.

The other case at the Cook County Hospital, upon whom before admission a midwife in doing a Crede in expressing the placenta, caused rupture of a pus tube. The patient came into the hospital with general peritonitis, and on opening the abdomen I found this ruptured pyosalpinx.

Regarding foreign tumors, as a rule, if the tumor is removable and small and is found early in pregnancy and can be lifted outside of or above the level of the inlet into the cavity of the abdomen, it may be possible to tide the patient over. But this tumor

is always subject to complications. If she has a dermoid, of course, it is apt to be fixed and adherent and its contents are apt to suppurate; hence the dermoid should be removed.

As a rule, treatment in all of these cases is by laparotomy unless the patient is so near term that she can be taken to a hospital and kept under competent supervision, so that if a twisted pedicle should occur or hæmorrhage take place into the cyst, which would be denoted by acute pain or some marked interference with the general condition, she could be operated upon. Otherwise, if the child is not viable we should not wait. It has been shown by a large number of statistics that with early operation, in the first four or five months of pregnancy, there are about 22 per cent of the children lost. If we leave them alone 16 to 17 per cent are lost. Therefore, there is very little advantage to be gained by adopting the waiting policy.

Dr. Rudolph W. Holmes: I wish to take issue with Dr. Beck in his statement that appendicitis in pregnancy is very common. It naturally falls out that the findings of the general surgeon on this question will give a higher proportion than would be the case of the obstetrician. The former has a practice fed by many men doing obstetric, so he naturally would see more accumulated instances of appendicitis in pregnancy than the obstetrician. I have repeatedly had women complaining of right-sided pain, but that is not appendicitis, although I am sure many a pregnant woman has had her appendix removed hurriedly on account of this right sided pain.

Dr. DeLee well referred to the fact that appendicitis is peculiarly dangerous in pregnancy on account of the enormous vascular and lymphatic changes incident to pregnancy. This, however, but partly meets the situation — the great difficulty, and at times, the seeming impossibility, of making a definite diagnosis of appendicitis in the face of pregnancy, is the critical problem.

In the early weeks of pregnancy, the woman has more or less nausea and vomiting, she has more or less abdominal discomfort, she probably has some leucocytosis, especially if she be a primiparous woman, and on account of the toxæmia she has some frequent epigastric pain. In the appendicitis case I have had the primary pain was not at McBurney's point, but in the epigastrium. Of course we all know that very frequently, in the non-pregnant, the primary pain is epigastric, but in my limited experience with this disease in pregnancy I would believe it is far more characteristic than in the non-pregnant. It is only later that the center of pain and tenderness, with fixation of the abdominal muscles, localizes at McBurney's point. Every time a woman in the first two or three months of pregnancy has an epigastric pain with a little leucocytosis, which cannot be too definitely stated is a normal phenomenon in pregnancy, are we justified in operating? After the mid-period of pregnancy it is a very frequent sign to have a right-sided pain: I have never worked up the statistics on the question but I would hazard the statement that at least one woman out of ten will have a more or less constant — or better a more or less recurrence of a pain in the right side of the abdomen after the mid-period of pregnancy. This pain is almost always in some relation to McBurney's point, and is due to the dextrotorsion of the uterus, throwing the right tube and ovary forward — with a resultant compression of these delicate organs between the utero-abdominal walls. The recognition of an appendicitis is so confused with the normal anatomic-physiologic phenomena of pregnancy that an early diagnosis is fraught with peculiar difficulties — so at once, the woman is placed in a dangerous situation by these difficulties of recognition, with the resultant delay. I am quite confident that many a so-called appendicitis in pregnancy is merely a mild toxæmia of pregnancy: the physiologic leucocytosis of pregnancy, coupled with nausea, epigastric, or perhaps right-sided pain, misleads one into operating erroneously for an appendicitis which does not exist. It is a very fortunate circumstance that true appendicitis is rare in pregnancy, for, with the great anatomic changes about the appendix which are concomitant to pregnancy, they make an appendiceal attack peculiarly lethal to the pregnant woman.

In regard to retroversion: Years ago my interne at the County Hospital reported for me and with me, a case of incarcerated retroversion of the pregnant uterus. She entered the hospital after two or more days of severe expulsive pains, simulating uterine contractions: she stated she was about 3 months pregnant, though the interne held she must be at full term, from her size. There was no dilatation, as the interne found, but he did not recognize the true condition. When I saw her the true condition was discovered. It required 29 hours by fractional catheterization to empty the bladder — in all 17 pints were removed in this period. After emptying the bladder we tried manual reposition, knee-chest position, and the bag, but with no result — and determined that the next morning we would open the abdomen to correct the faulty position. During the night she had spontaneous reposition, went to term, and had a living child.

I take issue with Dr. Lewis as to the frequency, and also, with Dr. Barrett, who has written a paper on the subject, in which paper he lays too much stress upon the operative intervention by laparotomy. We do not worry about the matters of which we are ignorant. Most women come to their physicians for the first examination when four or more months along and the uterus, if it were retroverted, has spontaneously corrected itself. It is very frequent to find a pregnant retroverted uterus. In the early cases by the employment of the knee-chest position, manual reposition, and a pessary, perhaps, we can control most such cases. If it goes to a later period, and the woman has entered the stage of a possible incarceration, manual

attempts, aided by the colpeurynter — or the mercury-bag, will rob the women almost always of the necessity of a laparotomy. Laparotomy is a last resort, not an early consideration.

DR. A. J. OCHSNER: I believe that the idea which has been expressed several times tonight, that nothing surgical, that is not absolutely necessary, should be done during pregnancy and that nothing surgical which is necessary should be avoided during pregnancy, fully expresses my views upon this subject.

I have done practically every kind of operation inside and outside of the abdomen during pregnancy, including the removal of fibroids from the uterus in two cases. The removal of these tumors seemed indicated because their location and size made accouchement absolutely impossible. I believe with Dr. Andrews, that if one simply bears in mind that one has to do with a woman who is handicapped, and that whatever one has to do surgically must be done with the slightest possible amount of traumatism with which an operation can be done, that one can do practically all operations in pregnant women with as much safety as one can do them on patients who are handicapped by any one of many other conditions.

Bearing this principle in mind, I have operated upon many dozens of pregnant women without losing any of them and very few of them have had abortions as a result of surgical interference.

DR. M. L. HARRIS: There have been so many things touched upon this evening that it is impossible for one to discuss them all or to give anything more than a brief summary of one's views regarding the subject of pregnancy and surgery.

Personally, my view is an exceedingly conservative one. I believe that no operation should be done during pregnancy unless it is absolutely necessary.

I venture to say, without having any statistics, that the point which Dr. Bacon brought out, namely, the chance of a fresh appendicitis starting up after the confinement or as a result of the confinement is infinitely less than would be the risk of starting up an abortion by trying to remove the appendix during pregnancy. Where there is a risk either way, take the lesser, by all means, and that is to let the patient go along when possible until she gets through her pregnancy and then operate.

So with the other conditions. If an emergency arises during pregnancy, of course, the emergency is paramount and must be attended to regardless of the pregnancy. In other words, attend to the greatest emergency. If the woman's most serious condition is pregnancy, attend to that. If it is some surgical complication, then, of course, attend to that.

Those are my views in general on a subject which is so broad that it cannot be discussed in detail.

DR. KAHLKE: I would agree with all the ideas advanced by the various speakers this evening except on a few individual points.

I would commend especially Dr. Bacon's idea of operating on every case of recurrent appendicitis if you get the case during the first month or two of pregnancy. I do not feel that you are taking any risk unless the patient is showing signs of toxæmia.

While complimenting Dr. DeLee on his splendid paper I would disagree with him on two points. One is in reference to the management of the uterus punctured by the curette. I think that the less you do in a case of that kind the better. Open the abdomen, close the wound in the uterus, and drain if septic. If the uterus is punctured by the ordinary sound dilator I would not do a laparotomy, providing the case is clean. Dr. DeLee stated that in case infection were present in the punctured uterus he would advise an abdominal hysterectomy. I would advise against extensive abdominal work, like hysterectomy, and would content myself with laparotomy, closure of the wound in the uterus, and drainage.

DR. A. P. HEINECK: Appendicitis in pregnancy is overlooked often or misdiagnosed. This subject has been discussed a good deal before the Surgical Society of Paris, and the Obstetrical Society of Paris. It was stated there that every case of appendicitis in pregnancy calls for the ablation of the appendix, irrespective of the type of the appendicitis and the state of the pregnancy. Within the past few years I have operated on two pregnant women who had appendicitis, so that I am inclined to share Dr. Beck's opinion that appendicitis, although its symptomatology may be definite, is not uncommonly overlooked by the obstetrician.

I once had occasion to look up the literature for perforations of the uterus through instrumentation from within, and I reached the conclusion that in the absence of evidence of injury to the intestine or any other intra-abdominal or pelvic viscus, the indication is not to laparotomize. In these cases you are only justified in performing a laparotomy if you have evidence of intra-abdominal hemorrhage or of some associated injury to some intra-abdominal viscus.

DR. DELEE (closing the discussion): I have also adopted the rule that as soon as an ovarian cyst is discovered it would be better removed. The fear of torsion, and incarceration in labor, especially if the cyst were large, interference with respiration, and the possible miscarriage from interference with the growth of the uterus have made me feel that the quicker an ovarian cyst is removed the better.

Very recently I had occasion to change my position, or modify it, in two cases where I diagnosed pregnancy with ovarian cyst on long pedicles, and I removed them. After opening the abdomen, I discovered that the cysts were in the ovary that carried the corpus luteum, and it was impossible to remove the cyst without also removing the corpus luteum. We know that in a large percentage of cases where the corpus luteum is removed, the hormonic influence of the corpus luteum being absent, pregnancy cannot continue. Both of those cases I thought would abort. I attempted to pre-

serve the function of the corpus luteum and picked it out carefully and implanted it in the broad ligament. This implantation did not succeed. Both cases aborted. I feel, therefore, that on the experience of these two cases I will temporize a little in early pregnancies with ovarian cysts, and at least wait until the function of the corpus luteum is no longer required, which is generally considered to be between the fifth or sixth month, or possibly wait until term and then attempt a solution of the case at term.

I was a little surprised to discover such a lack of unanimity among the surgeons as to the treatment of appendicitis. Of course there is a lack of unanimity regarding the treatment of certain conditions among the obstetricians, but I had thought that it was well settled that an acute appendicitis nowadays always meant operation. I see that Dr. Harris will temporize and that others will not.

I would disagree with Dr. Harris from my own experience which, however, is not so large in appendicitis as is his. Possibly it is not even so large in appendicitis and pregnancy, as that of Dr. Harris. I do not know. But it is not very large anyway because acute appendicitis in pregnancy is not a common complication. I believe that statistics in a large number of cases will bear me out, that the danger of appendicitis in pregnant women is greater than appendicitis in non-pregnant women or in the male, and, therefore, earlier operation should be carried out.

I agree to an extent with Dr. Beck regarding the frequency of appendiceal symptoms in pregnancy. I have seen a large number of women that presented symptoms of appendicitis, mild attacks of pain, a little tenderness in the right hypogastric region, and a little rigidity. Pels-Leusden has demonstrated decidual reaction in the appendix during pregnancy. How often, I do not know. It may be possible that some pains which I have described in pregnant women are due to mild attacks of swelling, or, perhaps a catarrhal appendicitis. But, on the other hand, there is the possibility of mistaking appendicitis for ureteritis. That possibility is very near. A majority of these cases of pain, tenderness and a little rigidity in the right lower corner of the abdomen are due in my opinion to ureteritis, and a little experienced examination should demonstrate an enlarged, tender ureter, by combined vaginal and abdominal examination. These cases have a bacteriuria also.

I am surprised that so much attention was paid to retroversion and retroflexion of the gravid uterus. I have not seen a complicated retroversion or retroflexion of the gravid uterus for five or six years. Occasionally in my office, in the early months of pregnancy I will find a uterus retroverted, and I slip it back and it will remain. It does not occur in the more intelligent practice any more.

Rupture of the uterus in pregnancy. Dr. Lewis made a mistake on that. I only touched upon rupture of the uterus early in pregnancy, spontaneous rupture. I did not mean to take up at all the subject of rupture of the uterus during labor or in advanced pregnancy. It was simply in combination, where a possible diagnosis had to be made between rupture of the uterus and a rupture of some other viscus.

I might take the opportunity to say that I would like to have a larger experience of a more favorable nature, before I would refuse to take out a uterus in the case of instrumental perforation, in the presence of sepsis.

I would also like to disagree with Dr. Heineck who adopts an ultra-conservative attitude in the treatment of perforations of the uterus, by attempt at abortion. Those of you that know the immense amount of damage that can be done and where the symptoms are from 12 to 36 hours almost absent, will bear me out when I say that if there is even a suspicion that the instrument has gone through the uterus, it is better to open up the abdomen to see whether the intestine has been torn from its omentum, whether there are any high rectal perforations, and whether there is a piece of catheter still under the liver or spleen, both of which I know to have happened, from my observation. In other words, it is wise not to be in the dark.

Whether or not it is advisable to take out a septically perforated uterus, only a larger experience than mine can decide. My feeling is that it is better to have the large mortifying organ out, leaving open and free drainage of the pelvis. The involuting uterus is one undergoing molecular disintegration. It might be argued that if you open up the broad lymphatic channels in the pelvis you are causing more danger than by leaving the uterus.

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD JUNE 23, 1916, WITH THE PRESIDENT, DR. CHANNING W. BARRETT, IN THE CHAIR

A STUDY OF THE MENOPAUSE WITH ESPECIAL REFERENCE TO THE VASOMOTOR DISTURBANCES

DR. CAREY CULBERTSON read an inaugural thesis entitled "A Study of the Menopause with Especial Reference to the Vasomotor Disturbances." (See page 667.)

DISCUSSION

DR. CHARLES S. BACON: This is a splendid paper, and I do not rise to praise or to endorse anything that has been said but I would present one or two objections for consideration.

Of course, the whole subject is extremely complicated. There are so many factors involved that it is difficult to satisfy oneself that certain factors or certain forces are not conflicting with any particular substance that is used in therapy or in a physiological test.

One of the first things I noted that surprised me was the statement offhand that the general secretion of the ovary, outside of the corpus luteum secretion, would not be considered. I am not in a position to say anything about the ovarian secretion definitely, but I do know of quite a number of good workers, for example Schottlaender, of Vienna, who has devoted considerable attention to the ovarian secretion and satisfied himself that it is important. It seems to me, in the consideration of a subject like this it ought to receive consideration. If it is of no value, that fact should be shown.

Now, in the treatment for lowering the blood-pressure by the use of corpus luteum extract some very remarkable, interesting, and valuable results have been shown. However, there are so many factors concerned here that we ought to have had more consideration devoted to other possible factors. The simple fact that there is no albumin or casts in the urine does not prove that there is not a nephritic element in the production of high blood-pressure, and there are other ways of testing the efficiency of the kidney and the possibility of the kidney being a factor in these cases. Then one other factor I will not take up because there are many others, but I will simply make one further statement and that is, in using and showing the value of corpus luteum extract as a valuable agent we ought to know what we are working with exactly, and I think before it is used generally there should be some way in determining the value of this substance, because I am convinced there is a great deal of difference in the activity of the substance, and it should be standardized in some way.

I will close by saying that I feel that this paper is really of great value to us and I wish to congratulate the author.

DR. CAREY CULBERTSON (closing): Regarding the dosage, there are several preparations of corpus luteum on the market. One is prepared in five grain capsules by Parke, Davis & Co., another is prepared by Armour & Co. There are other preparations, one made in Baltimore from the sow and used extensively in the East, which I have not used. I have limited myself to the use of these two preparations. I did not mix them in any one case. If I used the Armour preparation in one patient, I did not change to Parke, Davis & Co.'s preparation, and where I used Parke, Davis & Co.'s preparation I did not change to the preparation of Armour & Co. I used more of the Parke, Davis & Co.'s preparation than I did of the Armour preparation. If you do not give large doses, you do not get as prompt or quick results. I have found that in some instances we do not get the results that we obtain at other times; this I attribute very largely to the instability of the preparation or to obscure conditions in the individual patient which were not apparent. I find, however, that five grains, three times a day, of the Parke, Davis & Co. preparation, or three or four of the Armour capsules, would be sufficient to do the work which I did.

I should explain that I did not start this work for the purpose of reducing blood-pressure. I began giving patients corpus luteum extract who showed evidences of ovarian deficiency. The first patient showed this. I found she had a high blood-pressure, and I was surprised to find the blood-pressure coming down. Then I looked the matter up in the literature and found that other men described similar experiences, that blood-pressure would fall after the use of corpus luteum extract; but I began using it for the purpose of ameliorating ovarian deficiency. The vasomotor phenomenon appeared incidentally.

The question which Dr. Bacon brought up comes within the range of so-called internal secretion of the ovary apart from the hormone produced by the follicle. There is very strong evidence that is of some value, but that evidence seems to point to the fact that this other secretion of the ovary has to do in early life with the development of the genital organs; that it has no influence on menstruation, and it therefore would not be much of a factor, if any, in the menopausal change. That is the reason why it appeared to be ignored in my paper, and because there is some evidence brought forward on the part of some careful investigators that shows that these peculiar cells we find in the interstitial portion of the ovary represent nothing but storehouses for hormones.

The causes of hypertension must be borne in mind. The fact that one individual will have interstitial nephritis without albumin and casts is

recognized, but it did not seem to me that so many of my patients should have interstitial nephritis without albumin and casts. The twenty-nine cases I reported constitute but a small number of the patients I have had under my observation. I have eliminated all cases, except for contrast, showing nephritis or heart lesion or any pathological factors except those of normal change incident to pregnancy. For that reason I have studied many other cases, and the surprising thing is the small number which one has left when all pathology is eliminated. In cases with pathologic hypertension a relatively constant one, corpus luteum will not reduce blood-pressure and hold it down, but it may render the tension unstable. In other cases, such as nephritis, the albumin may disappear if tension is relieved. I have treated hypertension of pregnancy with corpus luteum and some interesting observations have been made even in patients not in the menopause. If patients have hypertension and you can make their blood-pressure jump, they will show the suggestion of hot flushes. We have such a case at the present time in which the extract was given with the hope of bringing the tension down. It would drop thirty points but go right up again the next day, so that the woman would feel uncomfortable. She would feel chilly, have hot and cold "spells," but she did not describe the typical hot flushes of the menopause. As I have said, if you can make the tension jump or "slip a cog," you can produce almost the same thing, and this is one case in illustration.

AN ADDITIONAL CONTRIBUTION TO THE THERAPEUTIC VALUE OF RADIUM IN PELVIC CANCER

DR. HENRY SCHMITZ read an inaugural thesis entitled "An Additional Contribution to the Therapeutic Value of Radium in Pelvic Cancer." (See p. 191, August, 1916.)

DISCUSSION

DR. THOMAS J. WATKINS: So far as my observation goes with regard to radium, I am impressed with it as the most efficient remedy which we have for the relief of symptoms. In a very large percentage of cases it stops bleeding and discharge and causes healing over on the surface, and I believe the use of radium is well worth while for temporary relief. As far as its curative effect goes, I believe there is very little to say about it.

DR. N. SPROAT HEANEY: I would like to ask Dr. Schmitz one question. It is probably well known among those who work with radium that they have united on the term "clinically well." What do they mean by that? Do they mean that the patient is free from symptoms, or by examination no evidences can be found of the disease, that the uterus is mobile, and there is no fixity in the pelvis that might be interpreted as the remains of the cancer?

DR. JOSEPH L. BAER: I would like to ask Dr. Schmitz whether in the cases reported the diagnosis of malignancy was always made microscopically, and whether he can tell in the operable series the time-interval of treatment before operation was undertaken, so that we might have some idea of what was accomplished by the prophylactic ray as he speaks of it. Lastly, I would like to ask the doctor whether he has any knowledge of the relative merits of radium and mesothorium.

DR. HENRY SCHMITZ (closing): As to the relative merits of mesothorium and radium. Their action is due to the rays, roentgen, mesothorium, or radium rays, all alike in their biologic and therapeutic behavior. We do not know anything about the physical properties of the roentgen, γ and mesothorium rays or any other radio-active substance. It does not make any difference as long as we can and do determine the amount of the rays we are using.

With regard to prophylactic raying. If the case is operable the patient is subjected to operation and after a few days we apply the γ-rays and X-ray. We combine the X-ray and radium, in every instance to attack any metastases along the hypogastric or iliac vessels and any cancer remaining within the field of operation.

In all the cases reported, a microscopic diagnosis was made of the tissues before and during the course of treatment, to see whether any changes were brought about in the cancer. Invariably we found that within three to six weeks cancer-cells could no longer be demonstrated in the tissues. I do not wish to deny that in the deeper seated region there might have been and were cancer-cells.

As to the question of increasing the thickness of the metal screen and decreasing that of the rubber. In my first work I used a heavy screen, but the longer I worked, the more I reduced the thickness of the screens until now I am using a one millimeter screen, and I think it is sufficient, provided radium is otherwise correctly applied. Personally, I feel that if I put on a heavy rubber screen I would exclude the secondary β or Sagnac-rays which are more destructive than γ-rays. They cause deep and painful burns.

As to the term "clinically well." In my first reports I made a differentiation between subjective and objective cure. Patients only subjectively improved were those in whom the local condition remained as at the beginning of the treatment. Later I did not pay any attention to subjective improvement and insisted in my statistics on objective improvement. If I cannot on bimanual examination elicit the existence of a tumor-mass the patient is "clinically well," and therefore she must be subjectively and objectively well or normal. I do not wish to say the patient is cured. It will take two and one-half years more of observation to say that a patient is cured.

As to the relief of symptoms, I will say that radium affords greater relief of symptoms than any other agent with which I am familiar. We cannot as yet speak of a curative action.